THE OREGON DUNES NRA RESOURCE INVENTORY

RESOURCE INVENTORY REPORT

for

THE OREGON DUNES NATIONAL RECREATION AREA

SIUSLAW NATIONAL FOREST

Pacific Northwest Region

1972

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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

Page

Mapping Units:

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF CHARTS, GRAPHS, MAPS AND PHOTOS

HOW TO USE THIS REPORT

This report was developed primarily for the use of the Planning Team. It provides background information which should be studied first, and descriptive and interpretative data to be studied second.

An atlas of thirteen 8"/mile air-photomosaics with delineations also accompanies this report. Data pertinent to specific locations on the ground can be obtained by selecting the necessary photomosaic sheet and identifying the specific mapping unit delineations and symbols. These delineations, represented by various connotative symbols, are described in the second section of the report. Physical, biological, and visual descriptions, photographs, considerations, limitations, and suitability or tolerance levels are provided for each mapping unit.

One overlay, combining water-affected areas, critical wildlife habitats or areas and unique wildlife areas, accompanies each photomosaic sheet. However, please note that on these overlays the actual water table is not shown, but rather the areas that have standing water on the ground surface or within 12 inches of the ground surface for some period of the year, usually late winter. The actual water-table affected lands are more extensive than shown on the overlays. The wildlife overlays identify eight critical wildlife habitats, one critical area and three unique areas. Critical wildlife habitats are those used by rare or endangered species, or habitats limited in extent, but used by both a great number of species and a great number of individuals. The critical area contains a great blue heron rookery. The three unique areas are of scientific value or contain species of special interest to visitors to the Recreation Area.

PART I

RESOURCE INVENTORY REPORT FOR INTENSIVE PLANNING ACTIVITIES

The information contained in this report represents the efforts of a team composed of a variety of physical, biological, and recreation specialists. The report is meant to serve the planning team and administrators with some of the basic information needed for an orderly development and maintenance of this scenic area.

Of immeasurable value were these previous works: "Coastal Sand Dunes of Washington and Oregon" by W. S. Cooper, "Plants of the Oregon Coastal Dunes," by Wiedemann, Dennis & Smith; and current studies conducted by Chris Maser, University of Puget Sound. Personal contacts with local citizens such as Wilbur Ternyik of Florence, Oregon, and with experienced Forest Service personnel were also invaluable. Excellent aerial photography, including color, black and white, and color infra red, taken during the spring high water levels and later in the fall of 1971 and 1972, was also used.

Two levels of investigations and interpretations were developed for this study which consist of an "overview" of low intensity level prepared on a photomosaic base at the scale of about 3"/mile, and a more detailed or high intensity level prepared on a photomosaic base of about 10"/mile.

This report represents the product of the high intensity level of resource data collection. It was prepared to serve the site planning needs but in some cases, additional onsite investigations will be required.

Major geomorphic-plant community types (landforms and erosional processes with related vegetation) were recognized and delineated, and the management interpretations or predictions were developed for these particular features.

RECREATION RESOURCE

The Oregon Dunes Area is an attraction within an attraction. It is a piece of landscape that does not appear to belong. It is an area composed and situated in such a way and with a type of climate that makes it an apparently highly usable piece of real estate.

The expected image to most, is an expanse of majestic timber, snowcapped mountains, and rushing streams. We all know Lewis and Clark wintered in a log fort surrounded by a dripping forest; the fur companies poured trappers into the mountains; wagon trains brought people to lush, fertile river valleys, and mountains lured the gold seekers. It's all there in history. We all know what the Pacific Northwest is and why we want to see it.

Yet, here also is a desert-like area. Open sands, dunes, struggling vegetation, howling winds swirling sand through the air, but the climate is mild, pleasant, often cool. The setting is tall timber, cool mountains; the atmosphere is desert and there is a limited amount of sweat!

This, then, is the Oregon Dunes Area. It combines a sand desert with a pleasant, comfortable climate. It is an area that modern man migrates to for pleasurable activities for here are experiences ranging from solitude to the roaring, snorting excitement of motorcycles and dune-buggy races. But, like the desert, the dunal area is fragile and easily altered. Its ecology is complex and can be turned, reversed, or even destroyed within one man's lifespan.

This physical resource inventory and analysis has been undertaken in an effort to identify this complex ecology and determine man's impact upon it. During the course of the inventory, it became evident that the ecology could not be completely isolated into neat packages. The dunes are living dynamic forms. They, and the life forms found there, revolve about the climate which includes the geomorphic process, which creates the landforms, which provide varying plant habitats, which promote wildlife habitats and populations, which affect the plant communities, which affect wind currents, which affect geomorphic processes, etc.

Man, upon entering into these processes, has inadvertently affected wind currents, ground-water flow, vegetation or another factor, which has resulted in increased administrative costs usually related to maintenance. In addition, the very features and processes for which the NRA was formed have occasionally been drastically modified. Hopefully, this resource inventory will end or at least minimize adverse impacts man may have upon the area as he tries to marry social needs and wants to the physical characteristics of the area.

History indicates that under Forest Service administration the area receives year-round use. However, peak use has occurred during the June through September period. Fortunately, this has meshed reasonably well with both resident and migratory wildlife which is one of the most sensitive dunal community members.

The future will hold increased challenges to meet the intent of the NRA legislation--increased usage of as well as conservation of the area's resources. To help meet these challenges, the inventory includes tables of tolerance levels, rated from 1 through 5 (1 being the most tolerant or best suited for a particular use or activity).

In the case of campgrounds of the NRA land base, only 2 percent are ideally suited to this use, and only 18 percent are conditionally suited; that is, some conflict with resources or geomorphic processes will occur if a campground should be built on that land. Thus, knowing that use of the area has peaked for short durations and limited for year-long use, those lands in suitable ratings should be considered for 365-day use season, while 2 and 3 suitability lands should be reviewed for shorter seasons of use. Perhaps the conflicts with resource or processes may be circumvented by administration (non-occupancy) during certain periods or seasons.

Master planning of the dunal area, in terms of recreational and visual opportunities, will be extremely challenging.

The list of recreational opportunities presented in this report is by no means complete. It only indicates the diversity of activities possible. Undoubtedly, the list will expand and perhaps contract as the social structure of the people changes. However, the physical resources, although affected by climatic seasons, will generally retain their constraints in terms of tolerance to man's infringement. It should be noted, however, that all opportunities will not be possible for a 12-month period.

The dunal landscape is formed by seasonal wind shifts and dramatic climatic differences. Past leisure patterns of the population have coincided with seasons offering the greatest range of activities. However, a current experimental shift of the educational year may well cause shifts in the leisure patterns and resulting use of the dunal area. This will tend to create greater possibilities of conflicts between man's social needs and the area's physical capabilities. A case in point would be visual. The winter seasons produce the most dynamic visual compositions in the dunes, but at the same time, restrict travel. If the leisure pattern shifts to greater winter use . . . .?

RECREATIONAL OPPORTUNITIES

Attempting to itemize the range of recreational opportunities afforded in the Oregon Dunes Area can be limited only by the imagination of the itemizer.

The land base consists of easily-traversed landscapes interwoven with landforms that invite educational, traditional recreation, play uses, and a climate that complements such uses.

From past observations, we can list these opportunities:

- Salt-water fishing
- Fresh-water fishing - lakes
- Camping
- Picnicking
- Hiking
- Boating - lake and stream
- Canoeing
- Horseback riding
- Dune-buggy riding
- Trail and motorcycle use
- Beach driving with semi-stock vehicles
- Beachcombing
- Wildflower observation
- Bird watching
- Hunting - big game, upland game, waterfowl
- Observation of sand movement (processes)
- Commercial rides - dune buggies, horses, aircraft
- Gathering forest products for pleasure - woodcutting, berry picking, driftwood collecting
- Nature study - educational
- Driving for pleasure - principally confined to Highway 101 and a few loop roads
- Photography
- Kite flying - model plane flying
- Sand surfing, sliding, and general sand play
- Swimming, snorkeling

These are recreation opportunities and not necessarily management goals for the dunal areas. Management will, of necessity, need to be tempered by physical, biological and visual constraints, and economic and social needs. Thus, the list of opportunities that become managed activities will increase and decrease during the course of time. The physical, biological and visual constraints will remain basically constant, but economic and social needs will change as society's values change.

CLIMATE

Climate plays an important part in the enjoyment, appearance and developmental processes of the dunes area. It has a direct effect on dune movement, persistence, and vegetation. The climate is mild with abundant precipitation and little or no seasonal deficiency of moisture.

The mean annual temperature is about 52^{o}F, with July average of 58^{o} and January average of 44^{o}. The precipitation has been recorded as about 65 inches with the months of December to February receiving 30 inches and June to August receiving 3 inches. Because of low summer evaporation rates, due to cool termperatures, the lack of summer or growing season moisture does not create a deficiency for the plants of this area.

Wind plays an essential role, both in its influence on the climate and the active agent in the dune-shaping processes.

On the basis of nearly 12,000 observations made by the U.S. Coast Guard, between 1937 and 1942, Cooper[1/] summarized the seasonal wind regime as follows:

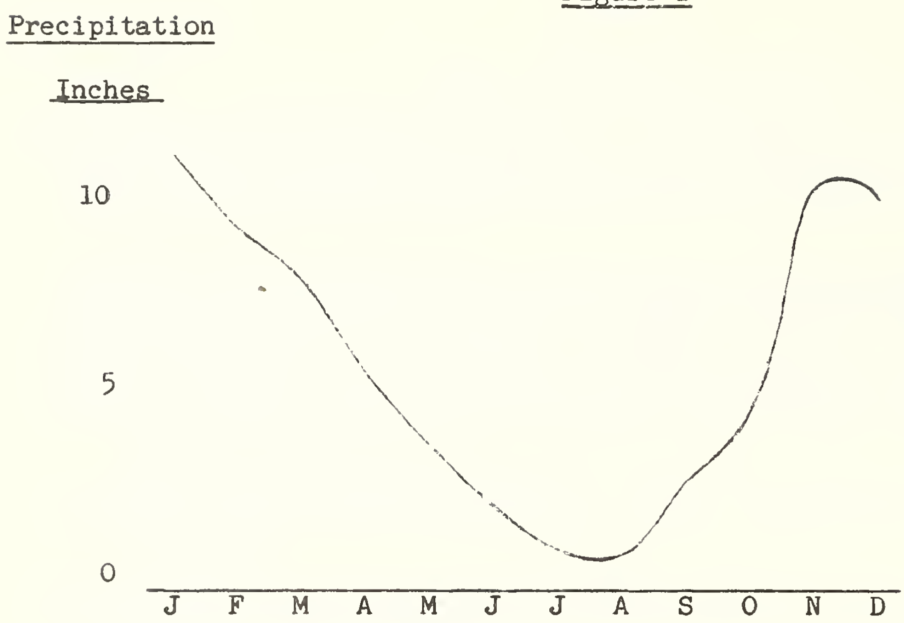
> The prevailing winds north of Cape Blanco (which is 40 miles south of Coos Bay) are in summer confined to the narrow sector N-NW with maximum usually at N. The onshore component causes them to attain, with remarkable regularity, high velocities in the afternoon when the temperature-pressure gradient is steepest. (High land temperature/low water temperature results in low pressure over land and higher pressure over the ocean.) The cyclonic southwest winds of winter strike the coast obliquely and are deflected by the mountain barrier so that a considerable component part acquires a direction nearly parallel to the coastal trend. This deflection toward parallelism to the coast, occurring both in summer and in winter, is of considerable importance in dune development. The angle at which the wind passes over the beach determines the proportion of sand that finds permanent lodgement — maximum amount when the wind is directly onshore, minimum when it is parallel to the shore. On this coast, where most of the effective surface winds are parallel to the shore or strike it at an acute angle, the amount (of sand) finding lodgement (a place to stop) is close to the minimum.

(The foredune with its stabilizing cover of beachgrass has greatly changed this condition so that now most of the sand is prevented from passing inland. The sand remains on the beach side of the foredune.)

Another way to say it is -- "The mountain barrier close to the shore causes deflection of the low-level (air) currents to a direction approaching parallelism to the (coastline)."

1/ Cooper, W.S. 1958 Coastal Sand Dunes of Washington & Oregon, pg. 19.

Figure 1



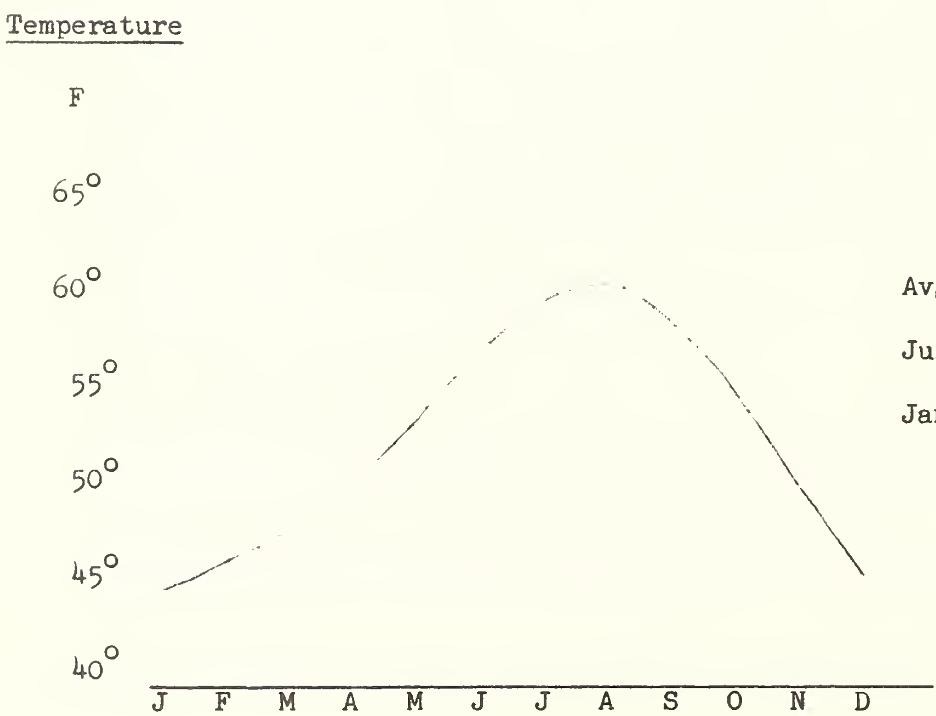
Inches

Avg. Annual - 65

June to Aug. - 3

Dec. to Feb. - 30

North Bend Station - Data from U. S. Weather Bureau



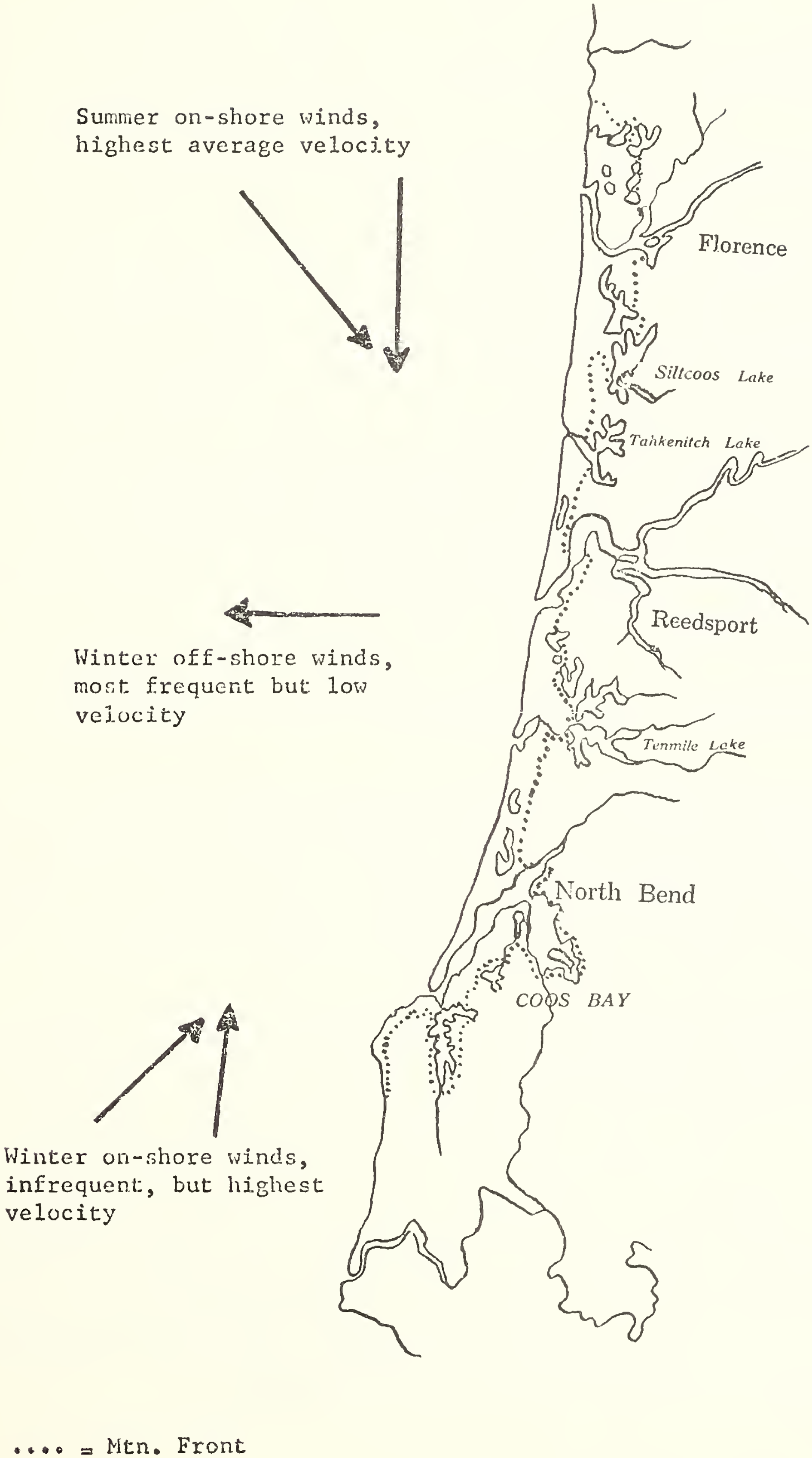
Avg. Annual 52° F

July Avg. 58° F

Jan. Avg. 44° F

North Bend Station - Data from U. S. Weather Bureau

Figure 2. SEASONAL WIND DIRECTION



GEOLOGY

The geological history of this area is not yet fully understood, but several sources of information provide some indication of past significant events.

Most of the area is related to Tertiary (60 million years ago) and Pleistocene (one million years ago) activities and deposited materials (sedimentary formation) formed during these periods.

The oldest sedimentary formations had their origin in the early Eocene period (55-60 million years ago) when a downward flexure of the earth's crust occupied the area from the Klamath Mountains to Vancouver Island, and east to the Cascade Mountains, and the entire region was under water. The initial deposits were volcanic in origin, but by middle Eocene (50 million years ago) uplift activity to the south and subsequent uplift activity in the southern part of the State, contributed arkosic sands (sands derived from the rapid disintegration of granitic rocks and containing feldspar) as marine deposits for a considerable distance northward. Volcanic activity continued throughout the Eocene period so that layers of volcanic materials are frequently interbedded with the wind-and-water-deposited layers. By late Eocene (45 million years ago), tuffaceous silt (volcanic ashes and pumice fragments) and clay-size materials, and organic materials began to be deposited by streams and rivers flowing from the surrounding highlands.

This deposition continued and increased considerably during the Oligocene period (beginning about 40 million years ago) when the arkosic sands and silts were also laid down in great amounts.

During the middle Miocene period (20 million years ago) vigorous volcanic activity resumed and uplift began which formed the Coast Mountains. This uplift reached its maximum height during the Pliocene (12 million years ago) and erosional leveling began. The historical record becomes a little more complex at this point, since the coast shows the effect of a number of changes in sea level which are superimposed upon the apparently rising coastline.

During the late Pliocene and early Pleistocene (one million years ago), extreme submergence occurred as indicated by wave-cut terraces found as high as 1,500 feet above the present sea level. Subsequent uplift lowered the shoreline about 300 feet below present sea level, and it was during this period that the rivers and streams cut their trenches across the continental shelf. Resubmergence to about 160 feet above the present sea level saw the beginning of the Pleistocene sand dune activity. These locations of "ancient aeolian (wind deposited) sediments", as Cooper called them, correspond roughly to present-day activity, but appear to have been much more extensive. These features were, for the most part, destroyed at maximum submergence but can be found at higher elevations not presently reached by the sea and dunal action. They can be distinguished by their red and yellow staining, frequent cross-bedding, coarse, well-worn grains and semi-consolidated nature. Some examples of these materials can be seen between Highway 101 and the south end of Siltcoos Lake.

A period of relative stability followed by a slight emergence occurred in late Pleistocene resulting in the formation of a terrace (referred to by Cooper as the "30-meter terrace") which can be found at an average distance of 150 feet above present sea level, but ranges from below sea level to about 210 feet above sea level, depending on the degree of local warping of the earth's crust.

Elevation changes since late Pleistocene are associated with the cycles of glaciation, with the last major lowering of the shoreline to 330 [1/] - 450 feet below present sea level which coincides with the maximum of the last (Wisconsin period) glaciation. As the glaciers melted, sea level again rose, creating the general features of the present coastline. With this event of resubmergence, the sand dune activity began again; the sand moved inland ahead of the advancing sea, reaching its maximum development at the end of the period of submergence, about 6,000 years ago, according to both Cooper and Fairbridge.

As a result of this submergence, the coastal rivers and streams are characterized by drowned mouths and valleys. On the Umpqua and Siuslaw Rivers, this drowning extends 25 to 28 miles upstream from the present outlets as evidenced by present tidal action. Deposition of river-transported sediments has since partially filled the edges of these river valleys.

A special situation exists where short streams not only could not fill their drowned valleys with sediments, but also were at least partially blocked by the sand dunes moving inland. Large, fresh-water lakes were formed with their surfaces above present sea level. Examples of these are Siltcoos, Tahkenitch, Clear and Eel Lakes.

In the period since maximum submergence, the sand dunes have undergone various cycles of stabilization and rejuvenation, depending upon vegetation, disturbance and shoreline processes. During the past 6,000 years, the shoreline has been in a state of relative stability although actively changing in a less spectacular sense. According to Cooper, the beach between Heceta Head and Coos Bay is the most stable part of the coast, with no building up (progradation) or erosion. At present, the dunes in this area rest on the broad, low surface of a rock terrace which slopes gently below sea level and extends inland up to two and one-half miles. Cooper calls this area the "Coos Bay Dune Sheet" and attributes its significance to the fact that "The great extent and continuity of receptive shore backed by terrain favorable to dune migration gives ample opportunity for development of materials and forces."

1/ Fairbridge.

Figure 3.

GEOLOGIC TIME CHART
OREGON DUNES N.R.A.

	Beginning Millions of Years Ago	Events
Recent		Relatively stable shoreline. Varying cycles of dune stabilization and rejuvenation (Episodes I, II, III-Cooper)
	.006	Glaciers melted and sea level rose causing resubmergence. Sand dune activity began again. Coast valleys and mouths of rivers drowned. Small streams blocked by sand dunes to form small lakes--Siltcoos, Tahkenitch, Clear, e.g.
	.17 to .20	Glaciers formed, thereby lowering sea level to 330-450' below present sea level.
Late Pleistocene		Slight emergence of land to about 150' above present sea level, forming "30-meter terrace" in ancient reddish sand dunes.
Middle Pleistocene		Relative stability.
Early Pleistocene	1	Resubmergence to about 160' above present sea level and beginning of "ancient" sand dune activity.
Late Pliocene		Uplift to expose shoreline about 300' above present sea level, with streams and rivers cutting trenches in continental shelf.
		Extreme submergence--terraces formed which are now visible about 1,500' above present sea level.
Pliocene	12	Maximum uplift of Coastal mountains with erosion.
Late Miocene		Uplift began.
Middle Miocene	20	Vigorous volcanic activity forming basaltic intrusions.
Oligocene	40	Increased deposition of tuffaceous silts and clays with large quantities of arkosic sands.
Late Eocene		Deposition of tuffaceous silts and clays by streams.
Middle Eocene		Uplift and erosion to the south contributed arkosic sands which were deposited alternately with volcanics.
Early Eocene	60	Geosynclinal basin existed and volcanic material was deposited under water.

Figure 4.

GENERALIZED GEOLOGIC TIME CHART FOR OREGON

ERA	PERIOD	EPOCH	PRINCIPAL GEOLOGIC EVENTS	AGE* (in millions of years)
CENOZOIC	QUATERNARY	HOLOCENE	Glaciers in mountains receding. Crater Lake and Newberry Crater formed by explosion and collapse of volcanic cones. Lava flows near Mt. Hood, at McKenzie Pass, and in central and southeastern Oregon.	.011
		PLEISTOCENE	Active glaciers in mountains. Growth of large volcanoes along crest of Cascades and in central Oregon. Pluvial lakes in south-central part of State. Mastodons and giant beavers in Willamette Valley; camels and horses in grasslands of central and eastern Oregon.	2-3
	TERTIARY	PLIOCENE	First eruptions of lava at crest of Cascade Range. Extensive outpouring of lava in south-central Oregon. Horses, rhinos, camels, antelope, bear, mastodons living in John Day country. Cascade Range high enough to form climate barrier. Drier climate east of High Cascade Range. Warm temperate climate west of Cascades initiates period of laterization.	12
		MIOCENE	Thick layers of lava extruded over much of State (middle and upper Miocene). Seas invade coastal areas; mollusks, fish, whales, sea lions. Oreodonts, rodents, 3-toed horses, giant pigs, rhinos, tiny camels, wolves, and saber-tooth cats living in John Day country. Mild, humid climate with extensive forests of Metasequoia. Last emplacement of granitic plutons in the State (Cascade Range) with accompanying mineralization. Coast Range begins uplift. Cascade Range growing in height.	26
		OLIGOCENE	Willamette Valley and parts of Coast Range covered by warm, shallow seas. Inhabited by abundant and varied mollusks. Warm temperate flora growing in both eastern and western Oregon, with Metasequoia, maple, sycamore, ginkgo, and katsura trees plentiful. Three-toed horses, camels, giant pigs, saber-toothed cats, oreodonts, tapirs in John Day country. Cascade Range too low to affect climate of eastern Oregon.	37-38
		EOCENE	A subtropical climate. Coal forming in coastal swamps. Palms, figs, avocados, pecans, and walnuts grow in central Oregon. Four-toed horses, rhinos, tapirs, crocodiles in Clarno area. Western Oregon covered by arm of ocean, locally many mollusks. Large volcanoes in area of Cascade Range.	53-54
		PALEOCENE	Not mapped separately in Oregon, but rocks of this age known in southern Coast Range.	65
MESOZOIC	CRETACEOUS		Most of State covered by warm seas. Ammonites, trigonia, and other mollusks, abundant in Medford and Mitchell areas. Tree ferns growing near Austin in Grant County. Formation of principal metalliferous deposits in State following batholithic intrusions.	136
	JURASSIC		Oregon largely covered by seas. Brachiopods, mollusks, and ammonites abundant. Some marine reptiles. Ferns, cycads, ginkgoes, and conifers growing on land areas. Period of serpentine intrusion with formation of chromite deposits followed by granitic intrusions in Klamath Mountains, Blue Mountains, and possibly Wallowa Mountains.	190-195
	TRIASSIC		Most of Oregon covered by warm seas. Sponges, corals, ammonites, gastropods, and nautiloids. Volcanoes active and widespread especially in northeastern and southwestern Oregon.	225
PALEOZOIC	PERMIAN		Warm seas cover much of State. Limestone reefs forming. Fusilinids common. Volcanism in northeastern part of State. Rocks now exposed in central and eastern Oregon.	280
	CARBONIFEROUS		Much of State covered by warm seas containing brachiopods and corals. Ferns and calamites growing on land areas. Rocks now exposed in Suplee area of central Oregon.	345
	DEVONIAN		Seas probably covered Oregon. Small limestone outcrops in central Oregon contain Middle Devonian corals (about 370 m.y.).	395
	PRE-DEVONIAN		"Pre-Devonian" includes the vast strech of geologic time extending back to the oldest rocks found on the earth. Rocks of this age are not known in Oregon. Nearest "pre-Devonian" rocks (450 m.y. old gabbro) in Klamath Mountains, northern California.	

* Adapted from U.S. Geol. Survey

GROUNDWATER

The bedrock underlying the Oregon Dunes National Recreation Area is the Coaledo Formation of Eocene age. It consists of clay, shale, and/or siltstone which is impermeable or, at best, yields only small amounts of water to wells. The very limited supply of water in this bedrock material is frequently salty and unsuitable for most uses. In Late Pleistocene time, when the massive glaciers were formed, the sea level lowered to about 400 feet below present sea level and a bench was formed in the Coaledo Formation along the coastline. When the glaciers melted about 10,000 years ago, the sea level began rising again. The ocean deposited sand and thin layers of silty clay material on the bedrock bench up to about the present sea level. Winds reworked the top portion of this marine sand, winnowing out the silty clay fine materials and shaping the sand into dunes. The sand now being blown in from the ocean reservoir consists, in part at least, of some of this marine sand without the silty clay portion. The dune sand is moderately to highly permeable. The silty clay layers in the marine sands below sea level greatly reduce the vertical permeability to about 1/150 of the horizontal permeability. This has been determined by numerous pumping tests conducted by the Groundwater Branch of the U.S. Geological Survey during extensive studies of the dunes between North Bend and Tenmile Creek. By monitoring many test wells while performing pumping tests on others it was noted that the groundwater surface was not lowered in the area around the pumping wells, but the water moved laterally toward the pumping wells through the sand confined between the layers of silty clay.

As a result of the research done by the USGS since about 1968, much information has been obtained relating to the development and management of the groundwater in the southernmost portion of the Oregon Dunes. Considerations which have been recognized if the existing and proposed water wells are heavily pumped are (1) sea water intrusion may occur from the ocean into the sands now containing fresh water, (2) sea water intrusion from the North slough to the east may occur, (3) the poor quality water in the bedrock under the sand may rise into the sands, (4) waste pulp liquor discharged into the ground by the Menasha Paper Mill could contaminate the groundwater, (5) the level of the many lakes could be lowered since the lakes are known to be continuous with the groundwater.

The sand absorbs and stores as fresh groundwater a large percentage of the 62-inch average annual precipitation. No saline (sea) water has been found in test wells in the area, even in those drilled immediately behind the foredune. Most of the groundwater in the sand discharges naturally into the ocean, North Slough, and Coos Bay through seeps and springs. Water quality tests have shown it to be soft and generally of good chemical quality except that it is slightly acidic, and in some places it contains enough iron to make removal necessary for some uses.

In mid-1972, it was reported that there were 18 wells producing fresh water for Coos Bay - North Bend Water Company, most of which was being used for industrial purposes. It has long been recognized by the developing water company that they must maximize the water production from the southern dunes while at all times minimizing the impact on the other uses of the area. In

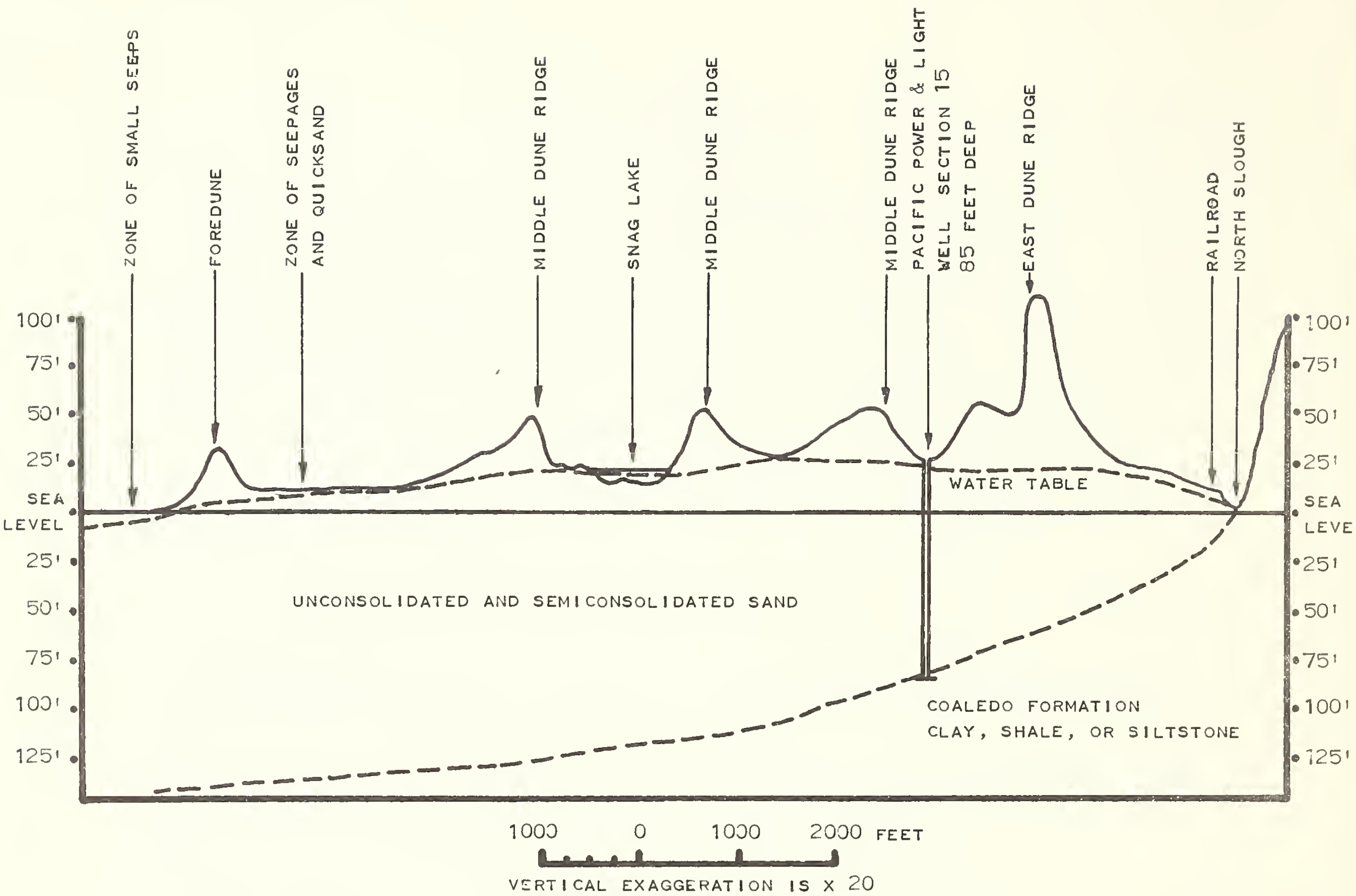
order to properly manage the groundwater resources of the area, the Coos Bay-North Bend Water Board asked the Groundwater Branch of the U.S. Geological Survey for assistance. An analog computer model of the dune area has recently been constructed, and tests are underway to refine its ability to accurately predict the groundwater response to manipulation by pumping.

Although considerable information is available on the groundwater in the southern dunes area of the N.R.A., very little is known about the remaining portion. It is assumed, therefore, that similar relationships exist elsewhere between the bedrock, marine sand, dune sand, annual precipitation, and groundwater storage. In the many localities where fresh water is seen to stand in the open dunes during the late winter and spring, it is assumed that this indicates continuation with the groundwater, since these small bodies of water have permeable sand bottoms. Widespread and numerous areas of "quicksand" conditions along the edge of the "occasionally wet transverse dunes" indicate that the hydraulic pressure of the groundwater is sufficient to buoy up the sand grains and greatly reduce its ability to support any concentrated loads.

Although sewage waste contamination of the aquifers lying below sea level is not expected to be a problem, it must be regarded as a probable threat to the groundwater and lakes lying above sea level elevation. This is due to the fairly high permeability of the windblown dune sand and the seasonally high water table throughout most of the Dunes area.

In considering any septic tank-leach field installations, it must be remembered that the clean windblown sand will permit the effluent to move very rapidly; it would not be unrealistic to expect that the effluent could reach the groundwater within a matter of a few hours to a few minutes, depending upon the location of the system within the various geomorphic units. Any consideration given to the installation of vault-type sewage containers must allow for the buoying effect of the high water table.

Water supply wells must necessarily penetrate well into the marine sands below sea level in order to avoid the possibility of a contamination by surface and near-surface activities. In most instances, a well drilled to a depth of 100 feet below sea level would be expected to produce potable water so long as the well is properly cased and a properly designed well screen is installed to limit pumping to the deeper aquifer near the bottom of the well.



DRAWING FROM
USGS WATER SUPPLY PAPER
1619-D

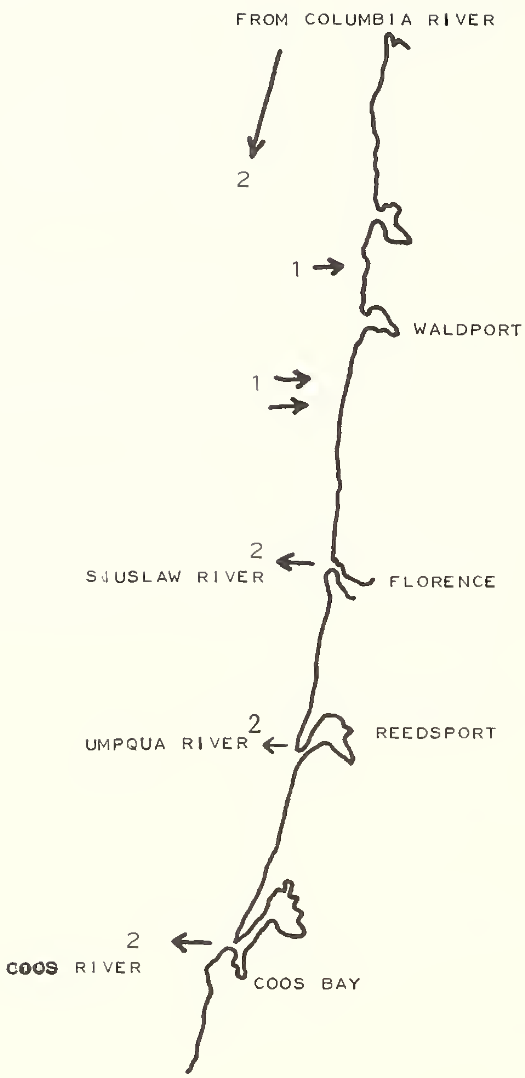
Figure 5. CROSS SECTION OF SNAG LAKE

SAND SUPPLY

The mechanical breakdown of older geologic formations both along the coast and within the far distant interior marks the origin of the sand-sized material making up the present sand dunes. The sand is transported by the river systems to the ocean which serves as a reservoir for the material. Ocean currents which flow northward in the winter and southward in the summer serve to distribute the sand along the coastline. Rocky headlands and the mouths of rivers tend to interfere with the sand movement, causing an uneven distribution of material at various places along the coastline. The tides and waves cause the sand to be moved up onto the beach where it becomes exposed to the winds.

Several theories as to the source of the dunes sand have been offered, but as yet the proof of the origin is lacking. It must suffice to say that the major portion of the sand making up the dunes as well as that still remaining in the ocean reservoir has been transported and accumulated under conditions different from those existing now. The present river system must, however, be credited with contributing a significant amount of sand to the area. Exceptionally severe winter storms are known to rapidly attack the established shoreline and foredunes, removing vast quantities of sand to the offshore ocean bottom to be slowly reworked along the coastline and up onto the beach again.

Figure 6. SAND SUPPLY



TWO PRINCIPAL SOURCES OF SAND SUPPLY HAVE BEEN RECOGNIZED AS

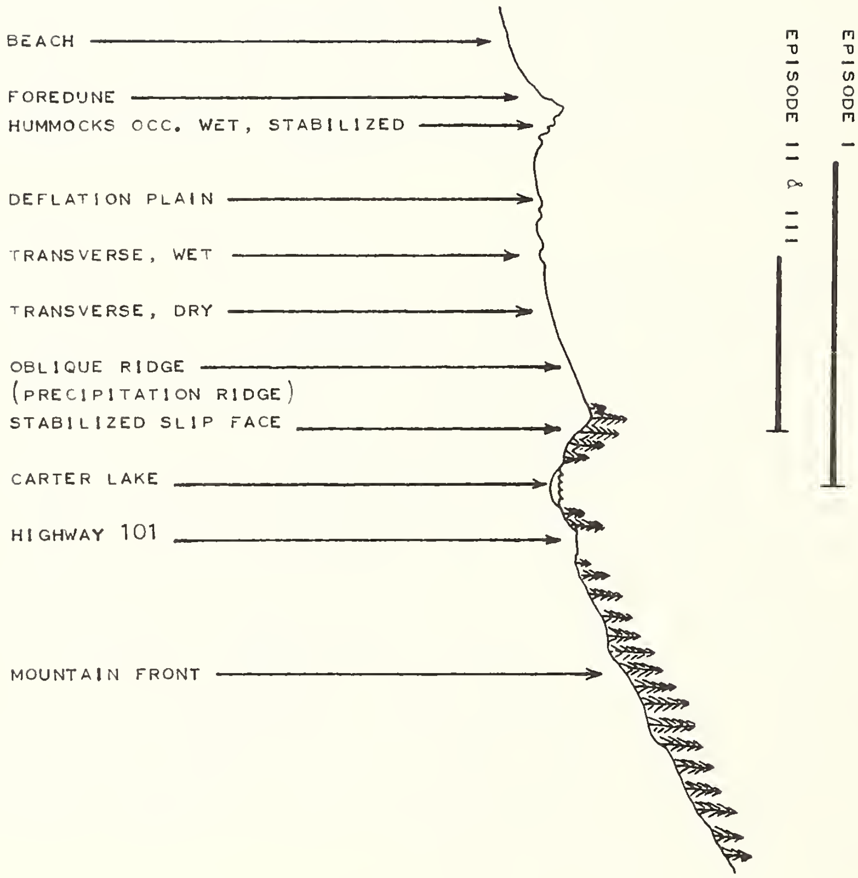
1. EROSION OF FORMATIONS EXPOSED TO WAVE ATTACK.
2. OUTFLOW FROM RIVERS.

SAND ACTIVITY

Any attempt to unravel the history of dunal activity is at best highly speculative. Perhaps the most comprehensive attempt to date has been made by W.S. Cooper in his book entitled "Coastal Sand Dunes of Oregon and Washington." Cooper made extensive use of aerial photographs, and by comparing dune ridge patterns he formulated a concept of three "cyclic episodes." Episode I is typified by a generally stabilized precipitation ridge and its windward deflation plain making up the inner margin of the present dunes area. Episode II is indicated by a secondary precipitation ridge which moved inland at a later time; in the area south from Tenmile Creek, the precipitation ridge has stopped short of the first one, while in most other areas, it has completely overwhelmed it in its inland march. Episode III is now going on, and the precipitation ridge is currently active with vegetative stabilization occurring on its windward deflation plain. In the Coos Bay-Tenmile Creek locality, development of the typical precipitation ridge - oblique ridge system is being repeated although on a smaller scale, and may be seen along the inland edge of the young deflation plain.

The long, essentially continuous ridge of vegetated sand paralleling the beach just above the high tide limit is the foredune. This feature had a very recent origin along the coast, being the product of vegetative stabilization by the European beachgrass which was used extensively in the 1930's in attempts to control sand movement. The foredune approaches 25 feet in height and greatly reduces the amount of sand moving inland off the beach. The onshore winds continue to move the inland sands on toward the precipitation ridge, leaving behind a newly-formed strip of deflation plain which is quickly invaded by pioneer plant species. The yearly cycle of sand removal to deflation base followed quickly by vegetative invasion and establishment has formed the ever-widening strip of vegetated lowland known as the deflation plain. Since the sand in the ocean reservoir is no longer able to make its way inland due to the barrier presented by the foredune, the dunal sand supply has been cut off except for an insignificant amount which blows inland during periods of extremely high onshore gales. It should be recognized then that we are now witnessing the possible end of Cooper's Episode III, and with it will come rapid vegetative stabilization and the death of the "living dunes" as we know them. The only alternative to this is to reestablish contact between the open sand of the dunes and the receptive shore by removing at least part of the foredune barrier.

Figure 7.

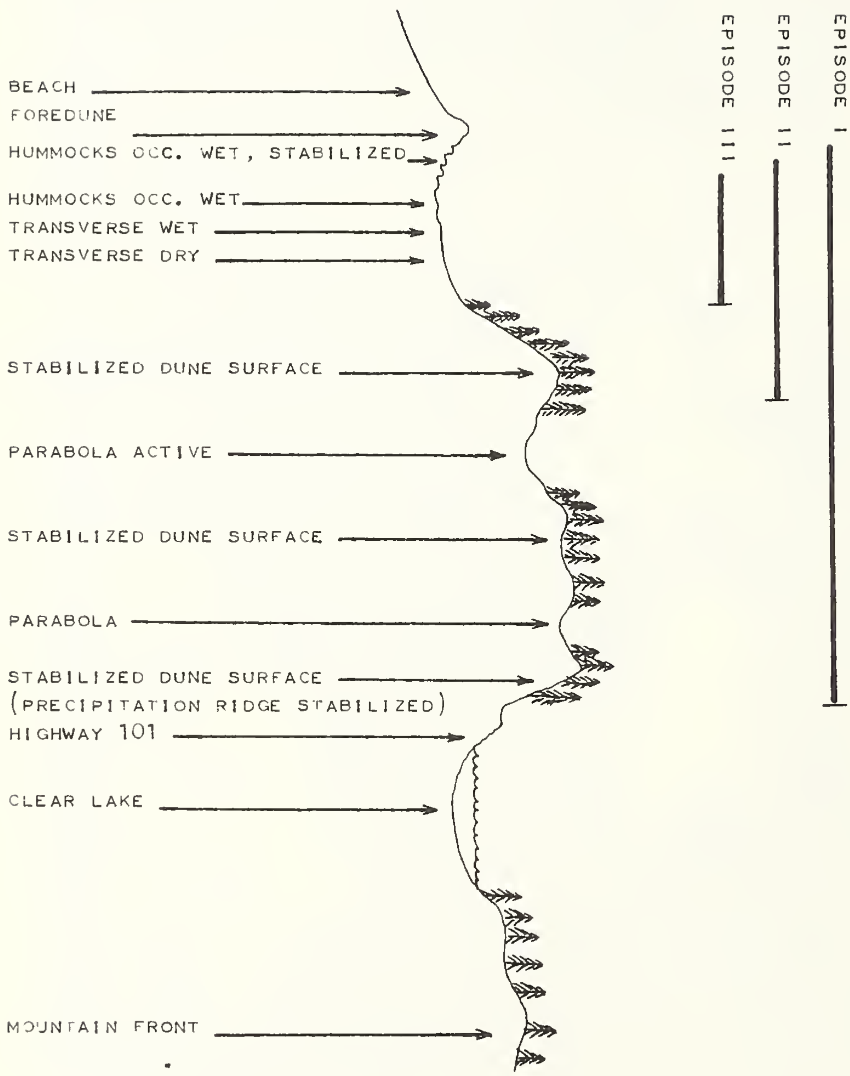


CROSS SECTION AT CARTER LAKE
HORIZONTAL SCALE SAME AS PHOTO ON FACING PAGE
VERTICAL SCALE EXAGGERATED FOR CLARITY

Figure 8.

CARTER LAKE

Figure 9.

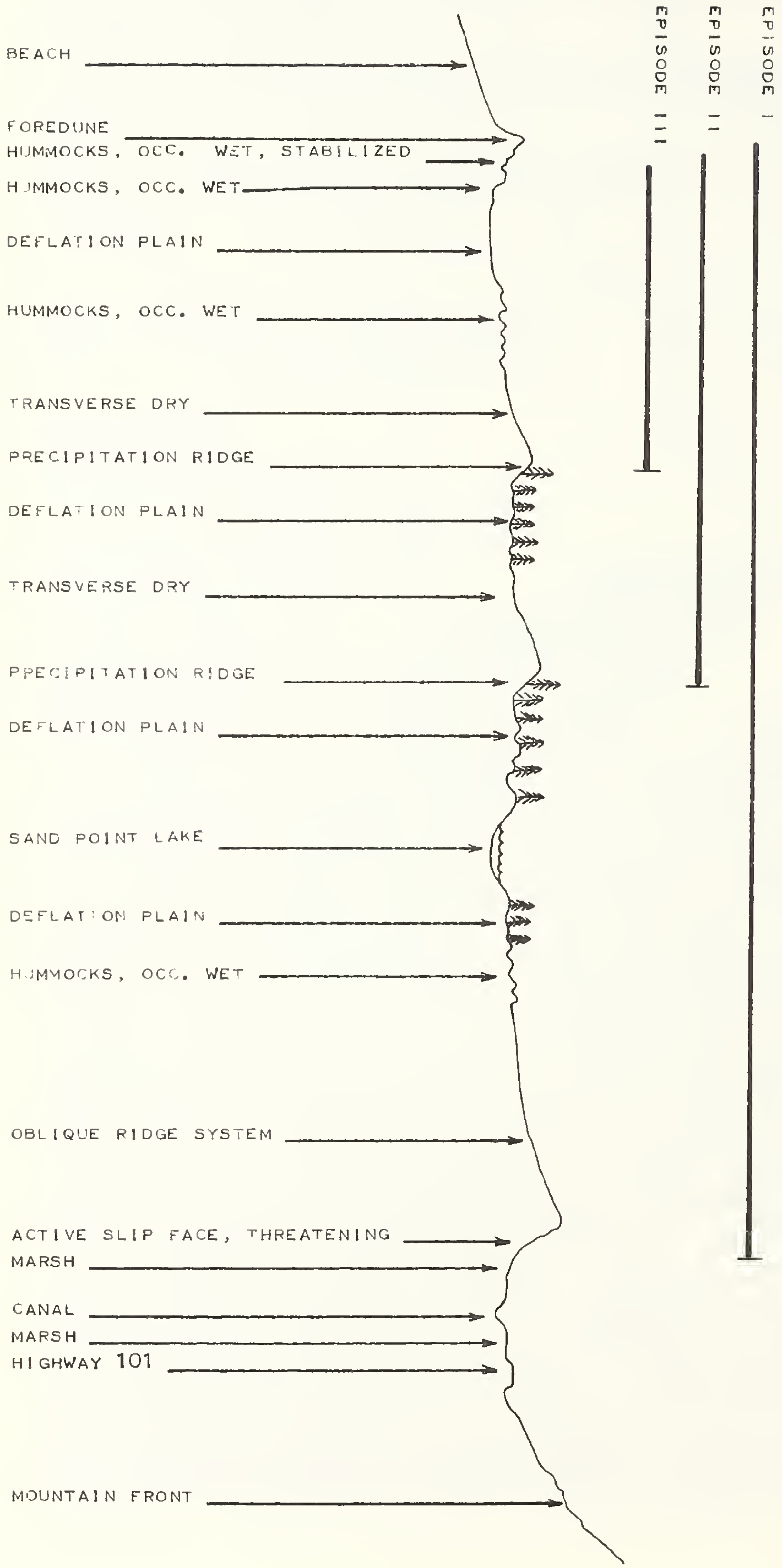


CROSS SECTION AT CLEAR LAKE
HORIZONTAL SCALE SAME AS PHOTO ON FACING PAGE
VERTICAL SCALE EXAGGERATED FOR CLARITY

Figure 10.

CLEAR LAKE

Figure 11.



CROSS SECTION AT SAND POINT LAKE
HORIZONTAL SCALE SAME AS PHOTO ON FACING PAGE
VERTICAL SCALE EXAGGERATED FOR CLARITY

Figure 12.

SAND POINT LAKE

DISEASES AND INSECTS

The Oregon Dunes National Recreation Area has a number of disease and insect problems. This area is interesting because man's activities have resulted in the introduction of several exotic tree species including shorepine, lodgepole pine, jack pine, Austrian pine, Maritime pine and Scots pine. Many of these species are not well adapted to the harsh environmental conditions present in some portions of the Dunes NRA.

Several developed and potential recreational sites have been examined for disease and insect problems. These areas include Siltcoos, Tahkenitch, Umpqua Lighthouse, Waxmyrtle, Lagoon, Eel Creek,Tenmile and Horsfall. Observations were made during the summer and fall of 1972 and were confined to the major tree species.

Trees most susceptible to disease and insect problems are primarily confined to the stabilized flood plain (FS) and stabilized dune (DS) ecosystems in developed sites that now exist and where future recreation facilities may be planned. Plantations and natural stands in the vicinity of the Waxmyrtle and Lagoon Campgrounds showed poor adaptability to the site as evidenced by heavy western gall rust damage and poor needle retention.

Diseases

Western gall rust incited by *Endocronartium harknessii* is common in both planted and natural pine stands. The rust has a wide host range (most native two- and three-needled pines are susceptible to infection). The geographic range of this native pathogen extends from Alaska to northern Mexico across the united States through the Lake States and into New England.

The rust spreads directly from pine to pine, infecting young shoots, twigs, and ovulate cones. The rust has been present in the Dunes area for many years as evidenced by main stem and branch cankers on older living and dead pines. Shorepine, lodgepole and Monterey pine plantations in the vicinity of the Dunes NRA are infected by the rust. The greatest damage has occurred to the more recent plantings of pine in campgrounds and DS plantations. Seedlings at Eel Creek and Waxmyrtle Campgrounds were dying from main stem infections. The seed sources were unknown. Plantations established 20 to 25 years ago to stabilize the dunes were heavily infected with the rust. In several plantations, trees in close proximity exhibited striking differences in degree of infection. Variation in the susceptibility of individuals of the same species to *E. harknessii* has been documented in the literature. The general growth habit and needle coloration of some trees indicated several seed sources and possibly different species were present. Unfortunately, there are no records of these plantings or their original seed sources.

Several other diseases were noted in various areas of the Dunes NRA. The identification of each problem and general location follows:

> Atropellis canker incited by *Atropellis* spp. caused limb cankers on shorepines in the Saunders Lake area.
>
> Pine needle cast incited by *Lophodermium* spp. has caused premature needle casting by pines throughout the Dunes NRA. Some plantations appear to be more susceptible to damage than others.

Red band needle blight incited by Dothistroma pini has been reported in the vicinity of Tahkenitch Lake on Monterey pine, but not in naturally regenerated shorepine.

Spruce needle rust incited by Chrysomyxa piperiana caused limited needle casting of sitka spruce in the DS areas south of Lagoon Campground.

Insects

Insect problems were confined to the pine stands in FS and DS areas. The pitch nodule moth, Petrova spp., was the most prominent insect. This insect attacks twigs, branches, and boles, producing conspicuous nodules or pitch masses. Larval feeding is confined to the cambium layer. Large trees are seldom girdled by the insect; however, mortality of seedlings was noted in some recent pine plantings in DS areas.

The insect that has the greatest potential for damage in pole-size shorepine stands is the pine engraver, Ips spp. This insect is mainly a secondary bark beetle that attacks distressed green trees. Any construction of roads, parking lots, buildings or drain fields that damage pine roots will place these trees under stress and increase their susceptibility to engraver attack. Sand displacement or landfill that increases soil depth around established trees will also have an adverse effect on trees. Dead shorepine in DS areas that were damaged more than eight years ago still bore evidence of old pine engraver attack; however, no active beetle populations were noted in adjacent green trees. The only active infestations were found at the Siltcoos and Waxmyrtle recreation sites.

Pine root collar and root feeding weevils, Hylobius spp., have caused damage to pine and sitka spruce plantations south of Lagoon Campground. These insects feed at the base of seedlings or on the roots. The presence of pitch flows at the root collar and layers of pitch-infiltrated soil near damaged areas are evidence of an infestation. Abundant feeding injuries were noted on the roots of many sitka spruce seedlings exhibiting poor vigor.

Freshwater mosquitoes are a problem in the Dunes NRA because of adjacent lakes, exposed water table in the depression plains, permanent marshy areas and intermediate flood plain water. Mosquito breeding areas also are abundant outside the recreational area boundaries.

MANAGEMENT IMPLICATIONS

Diseases

Non-local and exotic tree species in the Dunes NRA will gradually die out as climate and disease organisms exert their influence.

Western gall rust is the only disease problem of significance. Most cankers are confined to branches and limited branch killing will result; however, mortality of smaller pines, particularly those of non-local seed sources, is expected to continue.

No direct control measures are justified. In fact, natural selection pressure should be allowed to weed out the rust-susceptible trees.

The perpetuation of offsite individuals will result in lowering the disease resistance of the native pine population as the germ plasm of susceptible individuals is incorporated into the offspring of the population.

The best long-term control would involve the selection of seed from local sources of shorepine that exhibit resistance to the rust and appear to be well adapted to the site, exhibit vigorous growth, possess good needle retention and have no more than four or five branch cankers, preferably none. Trees selected for seed collection should be fairly evenly distributed throughout the Dunes NRA to ensure good genetic mix of suitable characteristics. Seeds should be bulked and mixed thoroughly.

Insects

Pitch nodule moth impact on recreational site trees will be insignificant except for the unsightly appearance of damaged trees.

Pine engraver could be a problem in established pine stands when recreational facilities are developed on FS and DS areas. Trees adjacent to development areas will have to be inspected periodically for pine engraver attacks, removed and treated to prevent beetles from developing and moving to other green distressed trees.

Additional plantings south of Lagoon Campground should be reconsidered. The activity of root-collar and root-feeding weevils will result in planting failures if no soil treatment is done prior to planting.

Mosquitoes will continue to be a nuisance in many of the campgrounds. Control programs will require coordination with local vector control districts.

PLANT COMMUNITIES OF THE OREGON DUNES N.R.A.

I. Introduction

A. Scope and Methods

Identification of plant communities was made by visual inspection; no attempt was made to take sample plots of the vegetation--and only major overstory and understory species were accounted for. These visual observations were made by traveling the open dunes and, when possible, by walking into stands of vegetation by way of old logging roads, dune-buggy roads, trails, etc. No effort was made to penetrate heavy thickets where travel was greatly impaired. Visual inspection of vegetation edges, stand inspection from vantage points, and infrared photo interpretation was used in mapping such areas.

In the time allotted to the study, it was not possible to visit every vegetated area within the N.R.A., nor was it possible to map small variations within vegetated stands. Where a stand had not been examined, but was geographically close to one already mapped with similar topography and aerial photo likeness, it was mapped with the same vegetation type as the one inspected. In some cases, as between herbaceous and shrub communities, there was no sharp boundary between types, but rather a blending of one type into another. In these cases, a line was drawn as closely as possible on the base maps to show predominance of vegetation types. Also, forest types typically showed variations dependent on factors like proximity to the water table, topography, exposure, etc. In these cases, it was necessary to map major forest types, ignoring small variations within them.

The mapping and classification of plant communities in the foredune and new deflation plain was patterned after A. M. Wiedemann's study of the vegetation of the Oregon coastal dunes, Contributions to the Plant Ecology of the Oregon Coastal Sand Dunes. Wiedemann's names of plant communities were changed to convey a broader more descriptive definition of the community in question; for example, his Dry Meadow Community of European beachgrass, seashore lupine and seashore bluegrass, was changed to Beachgrass Community. With the exception of the change of names, the species composition for the herbaceous and shrub communities were retained. Finally, his Forest Community was expanded to include forest types found growing in the new and old deflation plains.

B. The Dunes before the Spread of Introduced Plant Species

Very little documentation exists on the vegetation history of the dunes and the best information found was aerial photographs of the dunes dating back to 1941. The 1941 flight, indexed WO 943 2A-210, is on file at the Siuslaw National Forest Supervisor's Office in Corvallis, Oregon. A series of these photographs from Florence to Tahkenitch Creek showed essentially no vegetation on the dunes west

of the forest edge in the vicinity of U.S. Highway 101. The only vegetation found on the dunes was in the area known as "Goose Pasture" west of Cleawox Lake, patches of trees along Siltcoos River and Tahkenitch Creek, and a few isolated forested knobs; remnants of a forest that once might have covered this portion of the dunes. With the exception of "Goose Pasture," the dunes landscape in the 1941 photographs showed what the area might have looked like before the arrival of settlers to this portion of the Oregon Coast. The formation of "Goose Pasture" is well documented in Wiedemann's thesis as he traces its origin through records dating back to 1908.

C. Formation of the Foredune

Examination of 1943 photographs between the mouth of the Siuslaw River and the south edge of "Goose Pasture" east of Cleawox Lake, shows clumps of vegetation forming on both sides of the mouth of the river and extending south along the beach (War Department, Corps of Engineers, U.S. Army 1943. Northwest Sectors No. 68-6 & 69-6). These scattered clumps of vegetation, just barely visible in the photographs, were in all likelihood European beachgrass plants beginning to colonize the open sand along the beaches.

European beachgrass was introduced on the Oregon coast at the turn of the century and planted along the mouth of navigable rivers and wherever moving sand threatened man's creations or activities. After its introduction, European beachgrass spread "naturally" along the dunes following the high tide mark. Evidence of such activity was recorded at the mouth of the Siuslaw River and along its south spit by the 1943 Corps of Engineers' photographs described above. In contrast, the earlier 1941 photographs of the same area showed scattered clumps of beachgrass only in the vicinity of Goose Pasture.

As beachgrass spread along the beaches, it began to intercept and slow down the onshore wind, causing it to dump its load of sand--burying the beachgrass. Beachgrass is well adapted to grow--under repeated sand burial--where the nutrient rich sand blowing off the beach provided the best growing conditions and the grass thrived. Beachgrass undergoing numerous sand burials started forming a low ridge along the beach. The ridge grew slowly in height and width, forming the foredune or seawall. As the foredune grew in size, it provided a greater surface for the beachgrass to grow; became more effective in slowing down the onshore wind, causing almost total interception of the fresh supply of sand coming off the beach, and effectively cut off the supply of sand that had formed the sand dunes.

The foredune spreading the length of the National Recreation Area is not of uniform age, and its beginning is tied to the spread of

European beachgrass. A 1915 Forest Service Report quoted in Wiedemann's thesis mentions a seawall west of "Goose Pasture." Historical records also show that in 1908 Forest Service personnel set out thousands of grass roots in sand west of Cleawox Lake (Knowles, 1951), giving some evidence that beachgrass had spread from nearby seed sources and started colonizing areas along the beaches at different times in history.

C. Formation of the Deflation Plain

Beachgrass spread along the shore, contributed to the formation of the foredune, and effectively cut off the primary sand supply that had helped create the dunes. As the foredune grew in size and more and more of the primary sand supply was intercepted by the beachgrass, the onshore wind layers not dissipated by the foredune started eroding the sand immediately behind it. The erosion behind the foredune generated a new or secondary sand supply to the big dunes that had not been previously utilized, as formerly the windborne sand picked up off the beaches traveled unobstructed onto the dunes sheet.

Wind erosion of the secondary sand supply continued until the dune surface was lowered to the water table, at which point the effective sand movement ceased. The wind scouring of this area formed a low wet basin geomorphically known as a deflation plain. The water table plays a major role in determining the depth of the deflation plain; its level fluctuates 3 to 5 feet between wet and dry seasons and wind erosion of the deflation plain continued when the water level dropped below the surface. Eventually the deflation plain reached the lowest level it could erode in very dry years.

The origin of the deflation plain was linked to the spread of beachgrass and formation of the foredune, resulting in deflation plains of varying ages as this process got started along the shore. The deflation plain formation was gradual as can be witnessed by the inspection of aerial photographs dating back to 1941. The 1941 photographs between the Siuslaw River and Tahkenitch Creek show wind erosion down to the water table only in the vicinity of "Goose Pasture." The 1943 photographs of the same area show essentially no difference in the formation of the deflation plain. A flight taken in October 1952, DBQ-17H photograph series, shows essentially no deflation plain along the south spit of the Siuslaw River, but in contrast, one mile north and south of "Goose Pasture" shows an already vegetated deflation plain approximately 1/6 mile wide. Aerial photographs taken in August 1961, series EIJ-3, show that wind action along the south spit of the Siuslaw River had eroded the sand behind the foredune to the water table, signifying the formation of a deflation plain. In the vicinity of "Goose Pasture" the 1961 photographs show the deflation plain had doubled in width since 1952, forming a vegetated belt up to 1/3 mile wide. Photographs taken in October 1971 show a vegetated 1/4-mile-wide deflation plain along the south spit of the Siuslaw; north and south of "Goose Pasture" the vegetation belt was between 1/3 and 1/2 mile wide.

The normal rate of expansion of the deflation plain was altered in this area beginning approximately in 1956, when the Oregon Game Commission and the Forest Service started a wildlife habitat improvement program along the east edge of the deflation plain. These plantings were done every year, between the south spit of the Siuslaw and the Siltcoos River. Some of the species seeded were: bird's foot trefoil, meadow fescue, and perennial ryegrass. The wildlife plantations were encroached on by forbs, grasses, and shrubs "native" to the deflation plain. The wildlife habitat improvement program was abandoned in 1969.

The deflation plain has migrated east as evidenced by aerial photographs of the 1940's, 60's, and 70's. Where there was a wide belt of sand (1-1/2 mile wide between the Siuslaw and Siltcoos Rivers) the deflation plain has attained widths up to 1/2 mile. In areas where the forest edge is 1/3 mile from the beach, as along Threemile Lake, the deflation plain is about 1/4 mile in width, already closing the gap of open sand at the south end and mid portion of the lake. If present trends continue, the physical limit of growth of the deflation plain may be the edge of a forest, a river, lake, or in many cases, a man-made plantation.

In addition to the deflation plain along the beach created in the last 30-50 years, an older deflation plain lies inland between Tenmile Creek and Coos Bay. The 10-mile long wet marshy area starts as a narrow belt (1/10-1/5 mile wide) just south of Tenmile Creek, widening in the vicinity of Beale Lake, fanning out (about 1-½ mile wide at its mouth) to drain into Coos Bay. Major lakes within this deflation plain are: Beale, Sandpoint, Spirit, and Horsfall, all within the National Recreation Area boundary.

II. Vegetation Types of the Oregon Dunes National Recreation Area

A. Definition of Plant Communities

A plant community is the aggregation or association of plant species that, alone or together, have the same ecological requirements. A plant community can consist of one species, as in the pure beachgrass community growing on the oceanside of the foredune, or of many species, as in the early seral stages of scattered shrubs and trees in the deflation plain. Plant communities can be recognized either by their species composition or by their ecological requirements. The pure beachgrass community, as the name implies, is exclusively represented by one species, European beachgrass, which has the unique ecological requirement or ecological tolerance to withstand constant sand burial. It grows in pure stands on the windward side of the foredune because no other species can tolerate the abrasion and smothering effects of blowing sand. The more complex scattered shrub seral stage in the deflation plain will also have a characteristic species composition and will typically be found wherever similar growing conditions are met in stands of comparable age.

B. Definition of Pioneer Plant Communities, Plant Succession, Seral Communities, Climax Communities

Large sand dunes in their migration leave low wet areas in their wake where wind scouring has eroded the sand surface down to the water table. Windborne seed or seed carried by animals or water, find these wet sandy areas ideal for sprouting. Those that can tolerate moist open sand and low nutrient levels take hold and eventually form a low-lying layer of forbs and grasses. The forbs and grasses are Pioneer Plant Communities which colonize and modify the micro environment of the sand. They provide wind protection, result in less sand movement, lower the temperature, hold moisture, etc., all of which provide for more favorable conditions for less tolerant species of plants. Tree seedlings and shrubs begin to sprout, at first scattered and inconspicuous but slowly growing in size and density to become shrub thickets, and eventually forests. The orderly change from pioneer species of forbs and grasses, to scattered shrubs, to shrub thickets, to forests, are steps in Plant Succession with one plant community following another. The plant communities succeeding one another are known as Seral Communities or seral stages in plant succession. The plant species growing in these seral stages are known as Seral Species. The plant community that becomes dominant at the end of the cycle and can reproduce itself is known as a Climax Community, and the plant species growing at this stage are known as Climax Species.

Plant communities are very dynamic associations and are always in a constant stage of flux. In the case of seral communities, they are preparing the ground, making subtle changes in the environment to favor less tolerant species or species with more exacting requirements than their predecessors. Even the climax community is undergoing constant change, old plants are dying, making room for young ones to come in, the soil is slowly building up which in turn may favor a community of slightly different composition. Fire, flood, etc., are all effecting change in this complex life cycle. The sand dunes are a place where all these stages are accelerated; where one can possibly see the establishment of pioneer species on open sand and witness the arrival of a climax forest community in a lifetime--a very short time if we consider that a 4,000-year-old redwood or sequoia is a seral species in the mountains of California. The high rainfall and mild temperature of the Oregon coast make the sand dunes a very favorable place for rapid plant growth and accelerated plant succession.

One point needing clarification is the nomenclature pertaining to the common pine found growing in the sand dunes. *Pinus contorta* Loud is known as lodgepole pine, coast pine, beach pine, or shorepine. Shorepine has been chosen in this report as the common name for this pine.

C. Plant Communities of the Foredune and Deflation Plain

Two general types of plant-growing sites are found within the NRA--the deflation plain site and the stabilized dune site. There are

two main deflation plains--an old deflation plain spanning between Tenmile Creek and Coos Bay, and a recent deflation plain (30 to 50 years old) running along the shore from the mouth of the Siuslaw River to the mouth of Coos Bay. Minor deflation plains are found in the wake of moving dunes. They are relatively short-lived and plant succession taking place in them is similar to that of the deflation plains. Plant species found growing in the deflation plains are tolerant of high water and are typically species characteristic of wet sites rather than of sand dunes.

The foredune and new deflation plain are closely associated in some cases, sharing the same vegetation types. Raised areas of the deflation plain have plant communities similar to those found on the lee side of the foredune. Conversely, low areas of the foredune have plant communities similar to those found in the deflation plain.

The following plant communities are found on the foredune and deflation plains: pure beachgrass, beachgrass, grass, rush, sedge, low scattered shrub, tall shrub thicket, and shorepine forest. The description of each plant community will not be included here but will be discussed under the respective geomorphic units of the foredune and deflation plains.

D. Plant Communities of the Stabilized Dunes

The stabilized dunes are the vegetated portion of the sand surface ranging in elevation from just above the deflation plain to the mountain front of the Coast Range. Pioneer plant species of the stabilized dunes are adapted to tolerate sand burial and resist abrasion. In general, species of this growing site are adapted to grow under reduced moisture conditions, since greater water percolation downward through the sand lowers the effective amount of moisture available to plants on the high dunes.

The following plant communities are found on the stabilized dunes: shorepine forest, shorepine-kinnikinnic, transition forest, and stabilization plantations. There is a great deal of similarity between the deflation plain-shorepine forest and the stabilized dune-shorepine forest. They both share similar species like: shorepine, salal, evergreen huckleberry, and essentially grade into one another as the deflation plain forest grades out into the open dunes. Shorepine, salal, and evergreen huckleberry have wide ecological tolerance and grow as well in the wet deflation plains as they do on the high dunes, occurring on both forest types. The more specialized species can tolerate less drastic change in the environment. Willow and wax are only found in close association with wet sites, while rhododendron is usually found high above the water table. An overlapping of these species occurs as the deflation plain-shorepine forest meets the stabilized dune-shorepine forest.

The description of these plant communities is discussed under their respective geomorphic units with the exception of the transition forest. The transition forest is discussed next as a separate section.

E. The Transition Forest of the Stabilized Dunes and the Western Foothills of the Coast Range.

The transition forest grows on both the dune surface and the foothills of the Coast Range. There is little difference in species composition between the forest type growing on stabilized sand and those occurring on the soils derived from sandstone. Generally, the same overstory and understory species are found in both soil types but some striking differences in size and density of the trees are readily apparent. On the stabilized dune surface, the canopy is very open; the trees are relatively small, their crowns show the effects of wind-forming and pruning, and the shrub layer is dense to the point of being an impenetrable thicket. In contrast, the trees of the transition forest of the mountain range are much larger in size, the canopy is dense, and little or no shrubs grow on the forest floor. On the stabilized dunes, the most numerous tree is shorepine, with scattered sitka spruce and Douglas-fir; while on the mountain front, sitka spruce and Douglas-fir are dominant with scattered pockets of shorepine.

The transition forest plant community is a mixture of five tree species: sitka spruce, shorepine, Western hemlock, Western redcedar, and Douglas-fir. Minor tree species are alder and willow. Important shrub species of this community are: rhododendron, salal, evergreen huckleberry, trailing blackberry, salmonberry, thimbleberry, etc. There are four stages in this forest plant community: Transition Forest, Transition Forest Old Growth, Transition Forest Clearcut, and Transition Forest Second Growth.

The Transition Forest (TF). Forest stands of this type have never been clearcut, but might have been subjected to partial cutting to remove commercially valuable trees. They typically occur along the east fringe of the big open dunes. The stand is usually open and most trees are relatively small with little commercial value. Shorepine is the most numerous tree species; scattered sitka spruce (taller than the pines), occasional Douglas-fir, hemlock, and western redcedar trees are found scattered in the stand. In the south end of the NRA there are scattered Port Orford cedar and madrona trees. This open forest has a very dense shrub layer of rhododendron, evergreen huckleberry, and salal. In moist areas close to the water table, wax myrtle shrubs take the place of rhododendron. Along roads and in places where the natural vegetation has been disturbed, scotch broom has moved in, competing very successfully with the native shrubs. The extent of scotch broom invasion on the native vegetation can be appreciated in the spring when the showy yellow flowers are in full bloom.

Transition Forest Old Growth (TFO). This forest type occurs as remnant stands of old-growth trees that have never been cut. The only places where this forest type was mapped in the NRA were: a stand on the east shore of Cleawox Lake, and three pockets of old-growth trees in the vicinity of Threemile Creek. The trees are very substantial, attaining diameters of 3-4 feet d.b.h. Sitka spruce and Douglas-fir are the most numerous trees but occasional large hemlock and western redcedar are found. The shrub layer is dense in openings and at the edge of the forest stand but gets completely shaded out under the closed canopy of trees. The main shrubs are rhododendron, evergreen huckleberry, and salal.

Transition Forest Clearcut (TFC). These are logged-over stands undergoing plant succession following logging. The clearcuts within the National Recreation Area vary in ages from 2 to 12 years, and most of them are located in the northern half of the NRA. In clearcutting, all of the overstory trees are cut down, the slash and brush may or may not be burned and the site is seeded (naturally or artificially) or hand planted to conifer trees. Shrub species are the undisputed dominants of the older clearcuts where they form dense layers completely covering the ground. Forbs and grasses are important constituents of the younger clearcuts and persist in openings of older clearcuts. Some of the important shrub species are: rhododendron, evergreen huckleberry, salal, trailing blackberry, sword fern, bracken fern, salmonberry, thimbleberry, etc. Depending on the site, seed source, or planting stock, the stand may have any of the five species of conifers found in the transition forest. Hemlock, sitka spruce and Douglas-fir are the most numerous trees growing in clearcuts, but patches of western redcedar and shorepine are found. The trees are at first minor members of this stage of plant succession, but as the stand approaches ten years of age, the conifers become apparent, rapidly growing taller than the shrubs. In the Coast Range, normal plant succession following logging is occupation of the site by shrubs and deciduous trees followed later by the establishment of conifers. In modern forest management, the successional stages are shortened through quick re-establishment of conifer trees. The logging slash is burned to set back the shrubs; herbicides are used to "retard" their growth, and spraying is continued annually until the trees start growing taller than the shrubs.

The Transition Forest Second Growth (TFS). This is the most varied and most extensive stage of the transition forest type. This plant community is found between Highway 101 and the shores of Siltcoos and Tahkenitch Lakes and between the east boundary of the NRA and Threemile Lake. Second-growth stands are also found scattered on both sides of Highway 101, the length of the Recreation Area. The age of the stands vary from approximately 12 years to 50 years since cutting and the size of trees range from 10-foot saplings to 75-foot-high trees. The overstory composition varies from pure stands of sitka spruce, hemlock, or Douglas-fir, to mixtures of spruce and fir, to mixtures of all three species with scattered pockets of shorepine and western redcedar. In young second-growth

stands, the shrub layer is an important component of the plant community, but in older stands the shrub layer is completely shaded out. Important shrubs of second-growth forests are: rhododendron, evergreen huckleberry, salal, trailing blackberry, salmonberry, thimbleberry, ferns, etc. Representative stands of four different age classes were visited and the following are notes describing the vegetative structure of each stand. These stands are representative of the second-growth forests of the area and their description is not intended to include all age classes nor give a total picture of the second-growth forests of the NRA. A 15-20-year-old stand on the north shore of Tahkenitch Lake (T. 20 S., R. 12 W., W½ of Sec. 28) represents the first age class of second growth following clearcutting. The stand is on a southwest-facing slope and extends between the ridgetop and the lake. Saplings, 10-20 feet high, grow scattered throughout the site. Sitka spruce and hemlock are the most numerous trees; occasional Douglas-fir and western redcedar are also found. Also, there are pockets of shore pine trees on the upper part of the slope and on the ridgetop. Shrub species are a very important part of this community offering almost total ground cover between the scattered saplings. Rhododendron, evergreen huckleberry, salal, trailing blackberry, salmonberry, thimbleberry, swordfern, bracken fern, are some of the most numerous shrub species growing here.

The next representative age class of second growth is 20-30-year-old stands growing along Crown-Zellerbach Corporation's Booth Road (T. 20 S., R. 12 W., Sec. 16). Douglas-fir and sitka spruce are co-dominants growing up to 30 feet high. In some areas the fir is the most numerous tree, but spruce is a close second. Western redcedar is found scattered, usually in low, moist ravines. Very few hemlock and shore pine trees are found in these stands. Occasional alder trees are found on roadsides and where the soil has been disturbed. The trees grow dense and the understory is almost nonexistent, with occasional salmonberry and swordfern growing under the canopy. In partial openings and along roads, salal and evergreen huckleberry are the dominant shrubs, with some pockets of salmonberry. A few wax myrtle and scotch broom shrubs are found along roads.

A 30-40-year-old stand growing along a Crown-Zellerbach road near the Lane-Douglas County line (T. 20 S., R. 12 W., S½., Sec. 4) represents this age class. In this stand western hemlock is the dominant tree species with many scattered sitka spruce and western redcedar. Cedar is usually found associated with moist ravines and is most numerous in this area. Scattered pockets of shorepine found throughout this stand. In this age class the trees grow dense and attain heights of about 50 feet. There is very little understory under the canopy of the trees. Tall, spindly salmonberry and huckleberry shrubs are remnant species of an earlier successional stage and grow very scattered under the trees. Shrub species common to the transition forest are found along roads and in openings.

The oldest age class of the transition forest second growth is 40 to 50 years. A stand of this age class is found along the abandoned road leading to the old Siltcoos Lookout (T. 20 S., R. 12 W., N½ Sec. 4). This second-growth forest is almost a pure stand of sitka spruce trees, very dense and attaining heights of 70 feet. There are few scattered hemlock and western redcedar with some Douglas-fir pockets. Growing under small openings of the canopy there are tall salmonberry and evergreen huckleberry shrubs. Along roads and in major openings there are salmonberry shrubs, salal, evergreen huckleberry, vine maple, ferns, etc.

F. The Marsh Communities

Five variations of the marsh community are found within the National Recreation Area: deflation plain marsh, mountain front marshy valley fill, mountain front narrow drainageway marsh, mountain front lake , shoreline marsh, and river flood plain salt marsh. The first four are fresh-water marshes; the last one occurs in the estuaries where fresh and salt water mix. These marsh communities are discussed individually under their respective geomorphic unit descriptions and will not be covered here.

WILDLIFE RESOURCES

A great variety of wildlife species inhabit or use the Oregon Dunes National Recreation Area. This variety results from the meeting of two diverse life zones, the ocean and coastal mountain forest. Each of these zones has its own characteristic wildlife species. Where these two life zones meet, the interactions of wind, temperature, rainfall, sand, vegetation, fresh water and salt water have created a unique transition zone. This transition zone contains many of the wildlife species from the two life zones plus certain species which are only found in the transition zone. The number of wildlife species and the density of some species is greater in this transition zone than in either of the adjacent life zones. Most of the Oregon Dunes National Recreation Area lies within this transition zone.

Unique characteristics of the transition zone are expanses of open sand, estuaries, salt marshes, beachgrass plant communities and shorepine forest. Estuaries and salt marshes represent the transition between fresh and salt water. The beachgrass communities occurring on sand substrate are typical of the coastal dunes but are not found anywhere else in Oregon. Shorepine (lodgepole pine) is the most common tree species on the National Recreation Area. Shorepine is usually associated with high mountain forests or timberline; and it is not found in the coastal mountain forest. The shorepine is just one of the many plant species that is an expression of the uniqueness of this transition zone.

Many of the wildlife species from the coastal mountain forest and ocean are found in the transition zone. In addition, some unique species are present. In the transition zone beaver, snowshoe hares and ruffed grouse from the coastal mountain forest reside within several yards of harbor seals, pelagic cormorants and common murres typical of the ocean life zone. Starry flounder, sea perch and pacific herring move into the estuaries to feed or spawn. These oceanic fish may encounter largemouth bass and brown bullheads which have moved into the estuary from fresh water to feed. The meadowlark and marsh hawk--birds not usually associated with the coast--frequent the beachgrass plant communities. The wrentit, a unique song bird, is only found along the Pacific Coast in the transition zones. The transition zone has a greater number of wildlife species and a greater density of some species than either the coastal mountain forest or the coastal waters. Waterfowl that inhabitat the ocean and fresh-water lakes or streams, both use the estuaries. The abundance of waterfowl in the estuaries is much greater than in either the ocean or in fresh water. The forests of the transition zone have a greater number of songbird species and a greater density of most songbirds than the coastal mountain forests.

The transition zone between coastal mountain forest and ocean (or sand dunes) occurs along 140 miles of the 310 miles of the Oregon coast. The average width of the transition zone is probably less than 1 mile. The Oregon Dunes National Recreation Area contains approximately 27 percent (38 miles) of this transition zone in a relatively pristine state.

TABLE I. NUMBERS AND KINDS OF WILDLIFE SPECIES THAT USE THE OREGON DUNES NATIONAL RECREATION AREA *

WILDLIFE GROUPS	NO. OF SPECIES	TYPICAL SPECIES
FISH - SHELLFISH		
Shellfish	2	Razor clam, soft-shelled clam
Bay-ocean fish	54	Starry flounder, shiner perch, pacific tomcod
Anadromous fish	9	Coho salmon, shad, striped bass
Fresh-water fish	20	Largemouth bass, yellow perch, cutthroat trout
Sub-total	85	
AMPHIBIANS		
Salamanders	8	Oregon western red-backed, clouded salamander
Frogs - toads	4	Pacific treefrog, red-legged frog, bullfrog
Sub-total	12	
REPTILES		
Snakes	2	Common and northwestern garter snakes
Lizards	1	Northern alligator lizard
Sub-total	3	
BIRDS		
Oceanic	25	Sooty shearwater, pelagic cormorant, common murre
Shore-wading	54	Great blue heron, sanderling, western gull
Waterfowl	39	Mallard, surf scoter, whistling swan
Birds of prey	21	Red-tailed hawk, osprey, great horned owl
Song birds	108	Myrtle warbler, mountain quail, hairy woodpecker
Sub-total	247	
MAMMALS		
Marine pelagic	25	Gray whale,killer whale, bottle-nose dolphin
Marine coastal	4	Harbor seal, California sea lion
Terrestrial	50	Black-tailed deer, chickaree, coast mole
Sub-total	79	
TOTAL	426	

* From Appendix Tables 3 to 5 and 9 to 16.

WILDLIFE SPECIES

The National Recreation Area and the offshore waters are inhabited or used by 426 species of wildlife; 247 birds, 85 fish and shellfish, 79 mammals, 12 amphibians, and 3 reptiles (Table 1).

Birds

Birds are the most numerous and conspicuous species found on the National Recreation Area. Both the number and abundance of species vary with the seasons. Of the 247 species, 94 reside on the area during the entire year; 49 are summer residents or visitors, 68 are summer residents or visitors; 68 are winter residents and 36 are migrants (Table 2). Because of overlap in the seasonal activity of birds, there are at least 137 different species on the area during any time of the year (Figure 1).

The 247 species of birds may be placed in three major groups--aquatic birds, 118 species; song birds, 108 species; and birds of prey, 21 species (Table 2). The coast is a major migration route for many species of shorebirds and waterfowl and oceanic birds. A great number of these species spend the winter on the ocean estuaries, marshes, lakes, and rivers of the National Recreation Area. In addition, more than one-fourth of the resident species are aquatic. Most of the songbirds are either year-long residents or summer residents and inhabit the diverse grasslands and forests. The majority of the 21 species of birds of prey are residents and they use nearly all the habitats on the area.

Table 2. Seasonal status of the major groups of birds found on the Oregon Dunes National Recreation Area.

Seasonal Status	Major Bird Groups: Oceanic	Shore-wading	Waterfowl	Birds of Prey	Song	Totals
Residents	10	12	5	15	52	94
Summer Residents-Visitors	3	2	2	2	40	49
Winter Visitors	5	14	29	4	16	68
Migrants	7	26	3	-	-	36
Totals	25	54	39	21	108	247

Fish-Shellfish.

There are 83 species of fish present in the waters of the National Recreation Area. The greatest number of species are found in the estuaries. Estuaries,

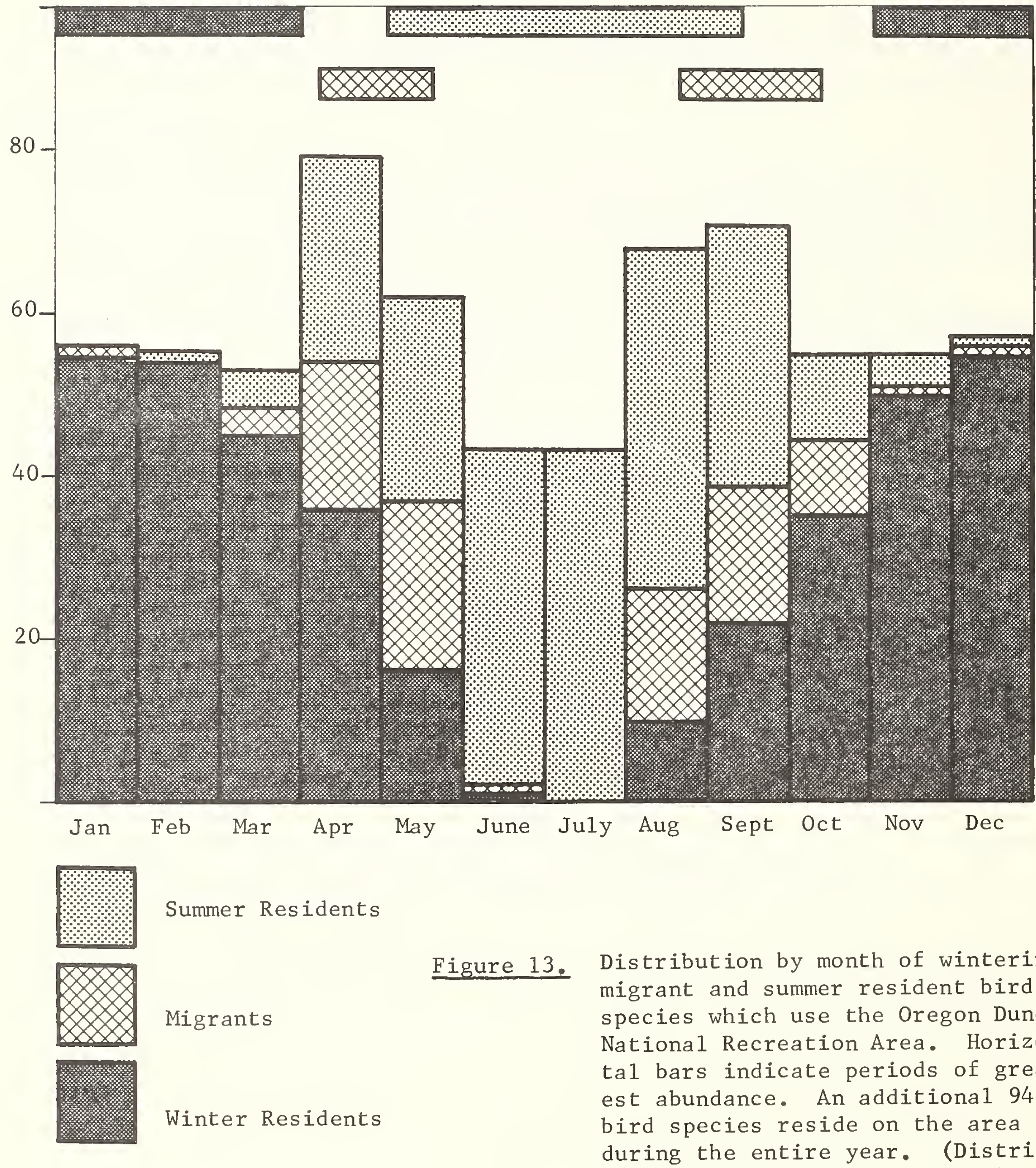


Figure 13. Distribution by month of wintering, migrant and summer resident bird species which use the Oregon Dunes National Recreation Area. Horizontal bars indicate periods of greatest abundance. An additional 94 bird species reside on the area during the entire year. (Distribution from Appendix Tables 14 to 16)

depending on their size, salinity and the season of the year, may be used by as many as 54 species of ocean and bay fish. Nine species of anadromous fish use the ocean, estuaries, fresh water streams and lakes during parts of their life cycles. Streams, lakes and ponds are inhabited by 20 species of fresh-water fish. Two species of shellfish, razor clams and soft-shell clams, are present. Scattered beds of razor clams occur on the beach for several miles on each side of the outlet of Threemile Creek. The tidal flats adjacent to the north shore of the Umpqua River contain beds of soft-shelled clams.

Mammals. A relatively large number of mammals use the National Recreation Area. Fifty species of terrestrial mammals are present. Nearly all of these species are residents. The majority of terrestrial mammals are quite secretive and seldom, if ever, seen by people. Four marine mammals, California sea lion, Stellers sea lion, elephant and harbor seal, use the beach, estuaries and the ocean immediately adjacent to National Recreation Area. Harbor seals are common residents. The two species of sea lions are seasonal visitors. On occasion, the rare elephant seal may visit the beaches. In addition, 25 species of marine mammals (whales and dolphins) may be found in the offshore waters.

Amphibians. The National Recreation Area is inhabited by 12 species of amphibians; 8 salamanders, 3 frogs, and 1 toad. The frogs inhabit the temporary and permanent water areas. Of the 15 species of salamanders in Oregon, 8 are found on the National Recreation Area. These interesting animals live in the forest litter, rotting logs and in or near water. These species are rarely seen by man.

Reptiles. In contrast to the large numbers of species present in other major wildlife groups, only three species of reptiles are found on the area. The common garter snake, northwestern garter snake and northern alligator lizard are relatively abundant on most of the area.

Invertebrates. The terrestrial and aquatic ecosystems on or adjacent to the Oregon Dunes are inhabitated with a great variety and abundance of invertebrate organisms. This report does not attempt to identify these invertebrate organisms; however, it should be recognized that these invertebrates are a major food source for most other species. Some invertebrates,like the common Dungeness crab,are not utilized by wildlife but by man as a food source.

Rare, Endangered and Peripheral Species. The National Recreation Area is inhabited or used by 10 species of wildlife considered or suggested as being rare, endangered and peripheral in Oregon or the Nation (Table 3). Five of these species, bald eagle, osprey, snowy plover, common egret and the white-footed vole, are of especial concern because man's activities within the National Recreation Area may have a detrimental effect on them.

Bald Eagle. The endangered northern bald eagle is a permanent resident of Oregon. In 1969, 39 nesting sites were known to exist in Oregon (Marshall 1969). One of these nest sites is in the vicinity of North Bend, Oregon, near the southern boundary of the Recreation Area. In recent years, a pair of eagles have nested near Tenmile Creek (Reiher 1972). Bald eagles do not presently nest on the Recreation Area. However, eagles from the adjacent

TABLE 3. RARE, ENDANGERED AND PERIPHERAL WILDLIFE SPECIES FOUND ON THE OREGON DUNES NATIONAL RECREATION AREA.'

SPECIES	STATUS* NATIONAL	STATUS* STATE	PERIOD OF USE	HABITATS USED
Brown Pelican	SU	P	June to Oct.	ocean, estuaries
Common Egret		P	Aug. to April	estuaries, marshes, river, lakes
Bald Eagle		E	Entire year	estuaries, beach, lakes, snags
Osprey	SU	R	April to Oct.	estuaries, lakes, snags
Pigeon Hawk		E	? to Feb.	conifir forests
Snowy Plover		R	Entire year	beach, tidal flats, sand spits
Caspian Tern		R	May, Sept., Oct	ocean, estuaries, beach
Purple Martin		SU	April to Sept.	near water, snags
White-footed vole		R	Entire year	stream edge
Elephant Seal		R	Entire year	beach

' Species list from Marshall, 1969; Olterman, 1972; U. S. Department of Agriculture, Forest Service, 1971; and U. S. Department of Interior, Bureau of Sport Fisheries and Wildlife, 1968.

* Status: P - Peripheral: A species whose occurrence in Oregon is at the edge of its natural range, and which is rare within Oregon, although not in its range as a whole. Special attention may be necessary to assure retention in our state fauna.

R - Rare: A species that is not presently threatened with extinction but is in such small numbers through its range in Oregon that it may be endangered if its environment worsens.

E - Endangered: A species whose prospects of survival and reproduction in Oregon are in immediate jeopardy. Its peril may result from one or many causes--loss of habitat or change in habitat, overexploitation, predation, competition, disease. An endangered species must have help or extinction will probably follow.

SU - Status Unknown: A species suggested as possibly endangered, or peripheral but about which there is not enough information to determine its status.

areas fish in the estuaries and lakes or feed on fish washed up on the beach of the Recreation Area. The many snags on the area are used as perching sites by these eagles. Marshall (1969) indicates that snags may be a very essential part of the eagles' habitat.

Osprey. The rare osprey is present in Oregon from April to October. A recent survey discovered the presence of 121 active nest sites in Oregon during 1971 (Roberts and Lind 1972). Twenty-two of these sites are located within 2 miles of the National Recreation Area boundary. In 1971, 18 of these 22 sites were active. Although there are no nests on the National Recreation Area at the present time, ospreys have nested near Horsfall Lake in years past (Reiher 1972). Large snags, especially those adjacent to their fishing areas, are preferred nesting sites (Lind 1972).

Osprey commonly fish in the estuaries and lakes on the Recreation Area. They use the snags near these waters as perching and feeding sites. The large snags on the Recreation Area are important as perching, feeding, and potential nesting sites.

Snowy Plover. Two populations of the rare plover exist in Oregon. One is present in some alkaline basins of southeastern Oregon during the summer. Marshall (1969) stated that "the entire Eastern Oregon breeding populations may number less than 50 pairs." A resident population also occurs on the coastal dunes. The Oregon Dunes National Recreation Area contains at least 27 percent of the snowy plover habitat on the coast.

The snowy plover feeds on the tidal flats, beach and sand spits on the recreation area. From April through June, it nests on the sand spits near the mouths of rivers and the driftwood tangle on the beach. The nesting season is a very critical period of time for this species. Marshall (1969) stated, "Recreational pressures along ocean spits and planting of vegetation to stabilize the sand could adversely affect this bird."

Common Egret. The northern limit of the common egret's range along the Pacific Coast is within Oregon. Several nesting colonies are present near the large lakes and marshes of Eastern Oregon. In recent years, increasing numbers of egrets have spent the winter in Western Oregon (Marshall 1969 and Reiher 1972). These egrets frequent the marshes, estuaries, lakes, and rivers of the Recreation Area from September to April.

White-footed Vole. The white-footed vole was called the "rarest microtine rodent in North America" (Maser and Johnson 1967). This species has a very limited range. It is only found west of the Cascade Mountains from the Columbia River to northwestern California. Since the species was first discovered in 1899, less than 60 additional specimens were captured (Maser 1972).

Unique Wildlife Species. Many of the wildlife species inhabiting the National Recreation Area could be considered unique. The whistling swan is one species that elicits much interest among local people and visitors to the area.

This white swan generally nests north of the Arctic Circle in Alaska and Canada. It spends the winters in the Atlantic and Pacific Coast States. From November to April, this swan frequents the marshes, lakes, estuaries and flooded grass deflation plains of the National Recreation Area. For the past 10 years, at least 200 swans per year have wintered on the south spit of the Siuslaw River. It is not uncommon to see 50 to 150 swans in this area during any day of the winter season.

Wildlife Habitats.

The 426 species of wildlife found on the National Recreation Area (Table 1) use 26 different habitats (Table 4, Figure 2). These 26 habitats were identified on the basis of major differences in vegetation, location and landform. However, these different habitats are not independent of each other; they form one integral unit.

Habitats are dynamic and include both living and nonliving components. Sunlight, wind and rocks are just as important a part of the habitat as the plants and animals. Within each habitat interactions between and among the living and nonliving components are continually occurring.

Each major habitat contains many smaller habitats (microhabitats) that exhibit differences in soils, moisture, temperature, vegetation, topography ....

Some habitats are changing rapidly while others remain relatively static. Plant succession on the grass deflation plain (DG) may go from grasses to scattered shrubs (DGL) to a dense thicket (DST) in less than 25 years. In contrast, the beach is one habitat that remains essentially the same over long periods of time.

Each habitat has its own complement of wildlife species. The distribution of a species among the habitats is dependent on the basic requirements of that species. The narrow set of requirements that some species have may only be met in one habitat or microhabitat. The requirements of other species are found in many habitats and these species are widely distributed. Some of these requirements may vary seasonally or geographically. The chickaree squirrel, for example, feeds on all conifer seeds and buds and it is found in the six different conifer forest types of the National Recreation Area. The red tree mouse spends nearly all its life in the canopy of conifer trees that are at least 25 years old. This mouse feeds entirely on the needles of a specific conifer, Douglas-fir (Maser 1972). Red tree mice are very limited in their distribution on the area because their requirements are only met in a few conifer forests.

The more structurally diverse a habitat is, the greater will be the number of wildlife species present. The habitats without much diversity are generally inhabited by fewer species but a greater number of individuals. The transition forest is the most structurally diverse habitat on the area and is used by 147 species. This forest contains trees of various species, ages and sizes; a mixed shrub layer, openings, snags, and many other components contributing to its diversity. The beach has very little structural diversity and

TABLE 4. WILDLIFE HABITATS OF THE OREGON DUNES NATIONAL RECREATION AREA '

Habitat
Rock jetties (J)*
Beach (B)
Ocean (O)
Estuaries (E)
Rivers - Streams (R-S)
Lakes - Bonds (L-P)
Marshes
Saltmarsh - meadow (SM)
Marsh (M) - in deflation plain
Mt. front shoreline marsh (MSM)
Mt. front Marshy valley fill (MMV)
Riparian - Lakeside (R-L) - vegetation adjacent to streams, lakes . . . .
Grasslands
Foredune (FD) - pure beachgrass
Hummocks, occasionally wet, stable (HWS) - mixed grasses, dense
Hummocks, wet (HW) - mixed grasses, moderately dense
Hummocks, dry (HA) - mixed grasses - light density
Deflation plain, grasses, rushes, sedges (DG)
Brushlands - thickets
Deflation plain, low scattered shrubs (DGL)
Deflation plain, thickets (DT)
Plantation (P) - beachgrass - scotch broom, shorepine
Conifer Forests
Deflation plain, shorepine forest (DST)
Shore pine forest ridge (SFR)
Transition forest (TF)
Transition forest, old-growth (TFO)
Transition forest, clearcut (TFC) 2-12 years old
Transition forest, second-growth (TFS_1) 13-25 years old
Transition forest, second-growth (TFS_2) 26-50 years old

' Plant communities of these habitats, if present, described in the preceding section on "Vegetation"

* Letters in parentheses are the symbols used to denote these wildlife habitats throughout the text and appendix.

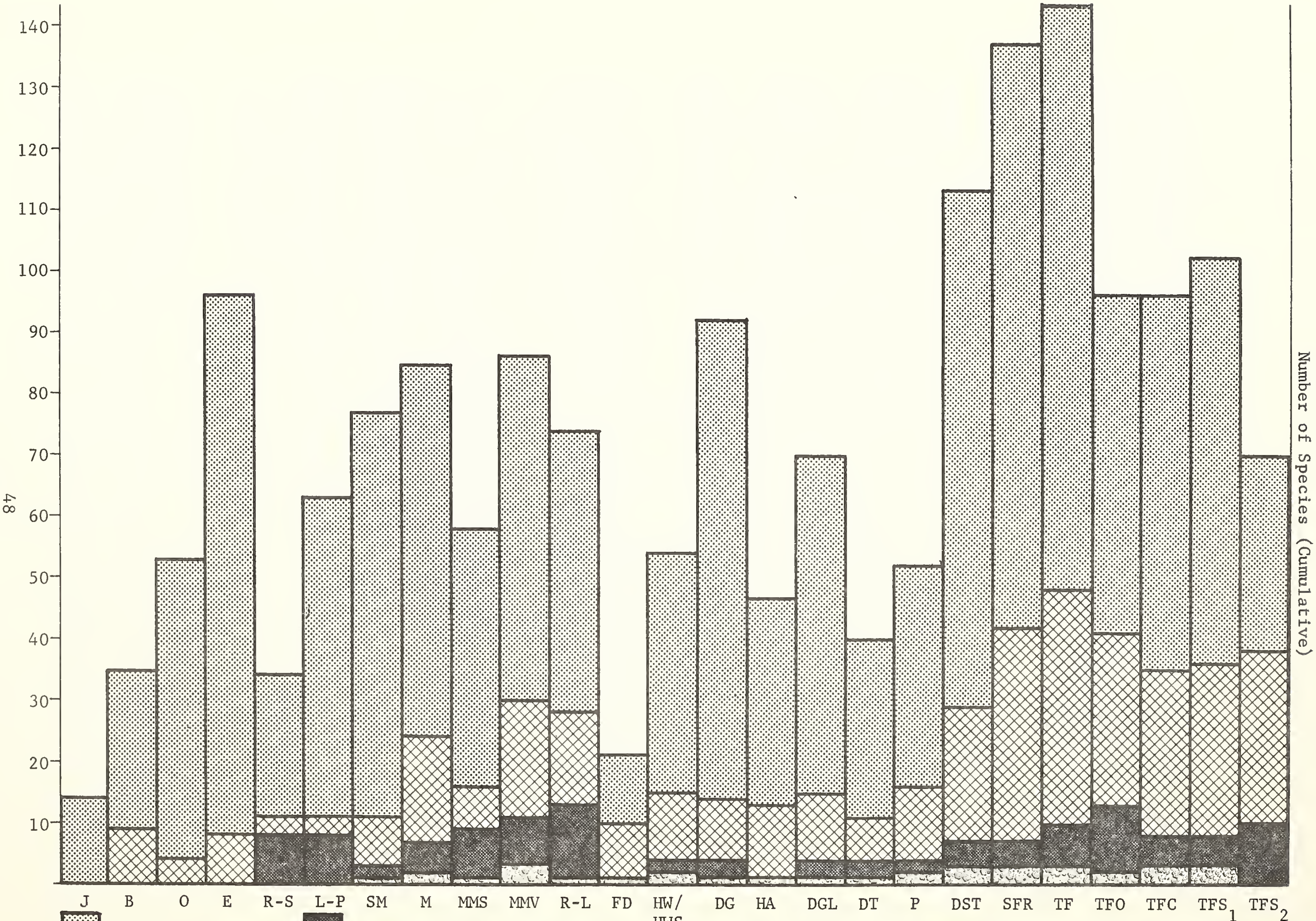


Figure 14. Distribution of reptiles, amphibians, mammals and birds among the habitats on the Oregon Dunes National Recreation Area. A species is commonly found in more than one habitat. (Habitats described in Table 2; distribution from Appendix Tables 9-11 and 13-16)

is only used by 35 species. Although the transition forest contains many species, there may be less than 150 individuals per acre. In contrast, there may be only three species of shore birds on the beach but over 1,000 individuals per acre.

CRITICAL WILDLIFE HABITATS - COMPONENTS

Of the 26 habitats found on the National Recreation Area, eight are critical to wildlife species. A critical habitat is one frequently used by a rare or endangered species or one which is limited in extent but is used by both a great number of species and a great number of individuals.

Beach. The driftwood tangle on the beach adjacent to the foredune and the sandspits at mouths of Tenmile Creek, Tahkenitch Creek and the Siltcoos River are the preferred nesting sites of the rare snowy plover. During the nesting season, April through June, these are critical habitats.

Old-growth Forest. Remnant stands of old-growth forest occur on less than 40 acres of the National Recreation Area. These large trees are important roosting and perching sites for many of the larger birds of prey. The endangered bald eagle, rare osprey, great-horned owl and red-tailed hawk all use these stands. Although none of these species were found nesting in these stands, they all favor the large trees or snags as nesting sites. The great blue heron also requires stands of large trees for nesting and roosting. A great blue heron rookery is present in a stand of old-growth near the southern boundary of the National Recreation Area.

The large trees in old-growth stands are potential snags. Snags provide nesting cavities for birds and dens for mammals. The rare osprey depends on snags for nesting. Other birds of prey depend on snags for perching. It may take 125 years for a tree to grow to a size suitable for nesting by great blue herons or bald eagles. An additinal lengthy period of time may pass before it becomes a snag suitable for cavity nesting birds. These wildlife species are dependent on the continuous availability of snags.

Estuaries and Salt Marshes - Meadows. Estuaries (including the tidal flats) and the adjacent salt marshes-meadows are an integral unit. The National Recreation Area contains two large estuaries and six small estuaries. These critical wildlife habitats are very limited in extent in both Oregon and the Nation.

Estuaries are the most fertile naturally occurring areas in the world. This fertility is a result of the nutrients and organic matter produced by the decaying vegetation of the salt marshes and meadows, washed down by the stream and brought in by tidal action. These nutrients and organic matter stimulate the growth of plankton and invertebrate organisms which are the basic food sources within the estuaries. These food sources attract many small animals to the estuaries which, in turn, attract other wildlife species.

Estuaries and the tidal flats are frequented by 166 species; 70 fish, 88 birds, and 8 mammals. Ocean and bay fish use the estuaries for spawning, feeding and as nurseries. All but 7 of the 88 birds frequenting the estuaries are shore birds, waterfowl, wading birds or oceanic birds. From

September to May, thousands of wintering waterfowl and shore birds concentrate their feeding activities on the tidal flats or in the estuaries. The common egret, a peripheral species, is commonly present. The rare osprey and endangered bald eagle fish in the estuaries and use the snags near the banks as perching or feeding posts. The sandspits adjacent to the river mouth provide nesting sites for the rare snowy plover. In addition, many terrestrial species from the habitats through which the estuaries pass, concentrate their activities near the estuaries.

Salt marshes and meadows, integral parts of the estuaries, are used by 77 species--66 birds, 8 mammals, 2 amphibians and 1 reptile. Many of the birds that use the estuaries also use the salt marshes and meadows for feeding, shelter and nesting.

Marshes. The three types of fresh-water marshes found on the National Recreation Area are critical wildlife habitats. These marshes occur on approximately 450 acres of the area.

The marshes of the deflation plain are used by 85 species of wildlife--61 birds, 17 mammals, 5 amphibians and 2 reptiles. These marshes are heavily used by 49 species of waterfowl, shore birds and wading birds.

From September through May, large numbers of migrant or wintering waterfowl and shore birds feed and nest in these marshes. Small flocks of the unique whistling swan use the larger marshes. Deflation plain marshes are important nesting areas for resident waterfowl, shore birds, and wading birds. Aquatic mammals, otter, beaver and muskrats, are also dependent on these marshes.

The marshy valley fill and shoreline marshes are adjacent to each other. They are essentially one unit. The decaying vegetation of the marshy valley fill releases nutrients and organic matter which contribute to the fertility of the adjoining lakes and shoreline marshes. The shoreline marsh is also an important source of these nutrients and organic matter. Nutrients and organic matter stimulate the growth of plankton and invertebrate organisms. In addition, the marsh teems with insect life. The marsh vegetation, plankton, invertebrate organisms, and insects are major sources of food for many wildlife species.

Shoreline marshes are inhabited by 58 species--42 birds, 7 mammals, 8 amphibians, and 1 reptile. Marshy valley fill is used by 88 wildlife species--66 birds, 21 mammals, 8 amphibians, and 3 reptiles. These two marshes share many of the same species.

Shoreline marshes are important spawning and rearing areas for many species inhabiting the lakes. The streams passing through shoreline marshes and the marshy valley fill are migration routes for anadromous salmonoids. Aquatic mammals, otter, beaver, and muskrat, use both marshes. These marshes are used by 36 species of waterfowl, shore birds and wading birds for shelter, feeding or nesting. During peak periods of use, November to March, it is not uncommon to see several thousand waterfowl in each of the larger marshes. The eight species of salamanders found on the Recreation Area all

use the marshy valley fill. The three species of frogs are abundant in both marshes.

Riparian-Lakeside Vegetation. The strips of vegetation adjacent to streams, estuaries and lakes are inhabited by 74 species--46 birds, 15 mammals, 12 amphibians, and 1 reptile. These species show a decided preference for vegetation adjacent to water. Waterfowl and shore birds from the water areas depend on this vegetation to provide them with nesting sites, food, and shelter. In addition, many terrestrial species from the surrounding habitats concentrate their activities near the water. These strips of vegetation also maintain the water quality of streams used as spawning and rearing areas by anadromous and resident salmonoids.

Mink, Pacific jumping mice, and myrtle warblers are common species in this habitat. The white-footed vole, one of the rarest mammals in North America, is a riparian species. The osprey and bald eagle, rare and endangered species, perch in the snags of the riparian strip when fishing in estuaries and lakes. The osprey prefers to nest in snags adjacent to the waters it fishes. All 12 amphibians found on the National Recreation Area are present in riparian forests.

Snags. Snags are critical parts of the habitats on the Oregon Dunes National Recreation Area. Six species of mammals and 24 species of birds depend on or prefer snags for nesting or den sites (Table 5). These snags are also important perching and feeding sites, especially to recently-fledged young who had trouble landing in the foliage of live trees. The importance of snags to the endangered bald eagle was emphasized by Marshall (1969): ". . . tall snags and snag-topped trees in the vicinity of feeding and nesting areas should be saved. These are used as perching sites and may be an essential part of the habitat."

Snags are very abundant on the entire Recreation Area. These snags are especially abundant in transition forest (TF), the shorepine forest ridge (SFR) and the deflation plain shorepine forest (DST).

TABLE 5. BIRDS AND MAMMALS OF THE OREGON DUNES NATIONAL RECREATION AREA THAT DEPEND ON OR PREFER SNAGS FOR NESTING OR DEN SITES.[1]

SPECIES	SPECIES
Birds	
Wood Duck	Red-breasted Nuthatch
Hooded Merganser	House Wren
Bald Eagle	Bewick's Wren
Osprey	Western Bluebird
Sparrow Hawk	Starling
Barn Owl	
Screech Owl	Mammals
Horned Owl	
Pigmy Owl	Marten
Saw-whet Owl	Raccoon
Red-shafted Flicker	Flying Squirrel
Pileated Woodpecker	Little Brown Bat
Yellow-bellied Sapsucker	California Bat
Hairy Woodpecker	Big Brown Bat
Downy Woodpecker	
Violet-green Swallow	
Tree Swallow	
Purple Martin	
White-breasted Nuthatch	

[1] Snags are also important as perching sites for all the hawks and falcons.

CRITICAL AREAS

A great blue heron rookery is located in a pocket of old-growth timber near the southern boundary of the National Forest. This rookery has been used for many years. In the spring of 1972, at least 18 nests in the rookery contained eggs. The rookery and the surrounding timber are critical to these herons during the entire year. While the nesting season lasts from February to June, these herons use this timber for roosting during the entire year. This site is identified as area number four on the white wildlife overlays.

UNIQUE AREAS

Many of the habitats on the National Recreation Area could be considered unique. The three areas classified as unique contain species of interest to the visitor or are of scientific value.

South Spit of the Siuslaw River. The grass deflation plain on the south spit of the Siuslaw River is the preferred habitat of the whistling swan. From November to March, approximately 200 swans feed on this area. During this same period of time, at least 20 different species of waterfowl use this area. The south jetty road runs parallel to this area. This road provides visitors with the opportunity to view the unique whistling swan and other species of waterfowl. This area is identified as area one on the wildlife overlays.

Vegetated Islands. Remnant stands of transition forest completely surrounded by large expanses of open sand are found from Cleawox Lake to Tenmile Creek. These islands of forest provide unique opportunities for studying isolated populations of small mammals. Reardon's (1959) study of the adaptive behavior of the deer mouse on one of these forested islands is only one of the many different areas or problems that could be studied. These islands are identified by the number 2 on the wildlife overlays.

Sand Lake. The grass deflation plain on the north spit of the Umpqua River, locally called "Sand Lake," is unique. This area attracts some of the largest concentrations of migratory and wintering waterfowl and shore birds on the National Recreation Area. The only other areas which have larger concentrations are the estuaries. In contrast to the other grass deflation plains which are dry after June, Sand Lake contains some water throughout the year. This water attracts many of the resident waterfowl and shore birds during the summer. Sand Lake is identified on the wildlife overlays as area number 3.

MINIMIZING THE IMPACT OF RECREATIONAL AND COMMERCIAL DEVELOPMENT AND ACTIVITIES ON WILDLIFE

Recreational

The wildlife species inhabiting the Oregon Dunes National Recreation Area will be affected by recreational developments and activities. The construction of facilities will alter habitats, and an increase in recreational activities will result in the harassment of wildlife. The degree of impact a facility or activity has on a wildlife species is dependent on many factors; the type of activity, location, magnitude and season of the year. In addition, each species has its own level of tolerance for harassment or the alteration of the habitat.

The anticipated impacts on wildlife resulting from the construction of facilities and recreational activities are described in table form for each habitat in the next section of the text. These tables also present methods and procedures by which these impacts can be minimized.

The tables in the next section of the text treat individual habitats. These different habitats form one integral unit -- the National Recreation Area. It is necessary to consider the impacts recreational developments and activities will have on the whole unit.

The following considerations will minimize the effects of recreational development and activities on wildlife species for the entire Recreation Area:

1. Avoid development of those areas identified as critical habitats, critical areas or unique areas.

2. Develop an active management program for rare, endangered and unique wildlife species.

3. Develop an active management program for game fish and animals with the Oregon State Game and Fish Commissions.

4. Develop a program of monitoring the impacts of recreational development and activities at intervals to determine that they are within acceptable limits.

5. Major activities and developments should preferably be concentrated in areas of existing developments (if critical areas are not threatened).

6. A few large areas (in noncritical zones) where use is concentrated, will have less impact on wildlife species than many smaller units scattered over the entire area.

Commercial

Two major types of forest are present on the National Recreation Area. One forest type grows on the stabilized sand dunes and is found west of Highway 101. The primary value of this forest is for recreation and wildlife. Logging activities in this forest type should be avoided. The second forest type is found growing on the coastal mountain front, generally east of Highway 101. Two large tracts of this coastal forest lie adjacent to Tahkenitch Lake and Siltcoos Lake. These tracts are owned by private industry and managed as tree farms. These two tracts contain several critical wildlife habitats. The cooperation of these industries should be solicited to ensure the preservation of these critical habitats.

VISUAL RESOURCE RATING

Rating the dunal landscape requires the analysis of each geomorphic-vegetation feature as a feature, without reference to any particular viewing position or location. This type of rating, though not completely conforming to R-6 visual resource inventory procedure, is necessary since use of the dunes is by walking (or meandering) through them, viewing features from all angles and directions.

Using the attached chart, the following visual resource ratings have been made for landscape character:

Foredune - Contains variety through all seasons.

Hummocks - dry - Contains variety through all seasons.

Hummocks - wet - Contains variety through summer season; often approaches unique variety during winter months, resulting from water reflections and incongruous landform-water relationship.

Deflation Plain - grass and shrubs - Contains minimal variety through all seasons.

Deflation Plain - shrubs and trees - Varies from minimal variety to variety caused by species composition and age.

Deflation Plain - forest - Contains variety through all seasons.

Oblique Ridge System - Contains unique variety during all seasons, but its uniqueness is greatly emphasized during the winter season by wind sculpturing.

Transverse Dunes - wet and dry - Contains minimal variety during winter months, broken by blowing sand patterns during storms. Moves up the scale to variety during summer months when the undulations created by wind-plucking and deposition exist.

Stabilized Dune Surface - Contains variety to minimal variety, depending upon shrub species composition and resulting spring and fall colors. Most areas are of minimal variety.

Stabilized Dune Surface Eroding - Contains unique variety when viewed against a backdrop of sand and ocean; however, reverts to variety when viewed against a backdrop of mountain front vegetation.

Parabola - Contains variety when viewed from the open sand areas, but contains unique variety when viewed from inland sectors.

Stabilized Slip Face - Contains variety to minimal variety, primarily minimal variety.

Active Slip Face - Contains unique variety to variety, primarily related to scale of the slip face in relation to its surroundings.

Conditionally Stable Slip Face - Contains variety during all seasons.

Rolling Partially Stabilized Dune Surface - Contains variety to unique variety during all seasons. Usually the interactions of the rolling landform and the open vegetation will keep this feature in the unique variety class.

Flood Plain - Active - Normally contains variety to minimal variety as a composition.

Marsh - Contains variety, but will at times contain unique variety.

The final phase of rating the visual significance of the above features would be to indicate the visitor interest in each feature. Visitor interest is normally rated in terms of seen area relative to existing or proposed travel corridors. However, in the case of the dunal landscape, where final planning has yet to begin, visitor interest at this stage cannot be established. However, geomorphic features can be evaluated as to their "use appeal." This will tend to indicate relative importance of the features as potential travel routes. Later, after travel routes have been determined in the planning process, sensitivity levels of seen areas can be established.

Using this theorem, we find the potential travel corridors (use appeal) for the dunal landscapes to be:

Level I

Oblique Ridge System
Stabilized Dune - Eroding
Active Slip Face
Rolling Partially Stabilized Dune Surface
Beach
Lakes

Level II

Foredune
Hummocks, Wet and Dry
Parabola
Conditionally Stable Slip Face
Deflation Plain - Grass, Rushes and Sedge
Transverse, Wet and Dry

Level III

Deflation Plain - Low shrubs
Deflation Plain - Tall shrub thicket
Deflation Plain - Forest
Stabilized Dune Surface
Precipitation Ridge, Slip Face stabilized
Flood Plain, Active
Flood Plain, Stabilized
Marsh

	Unique Variety	Variety	Minimal Variety
Landforms	National Importance Unusual Topography Diverse Type Etc.	Moderate Importance Common Topography Uniform Type Etc.	Minimal Importance Monotonous Topography Monotonous Type Etc.
Rock Formations	National Importance Unusual Size Unusual Shape Unusual Texture Unusual Distribution Etc.	Moderate Importance Common Size Common Shape Common Texture Common Distribution Etc.	Minimal Importance Monotonous Shape Monotonous Texture Monotonous Distribution Etc.
Water Forms lakes	National Importance Unusual Size Unusual Shoreline High Water Quality Unusual Reflections Etc.	Moderate Importance Common Size Common Shoreline Average Water Quality Common Reflections Etc.	Minimal Importance Monotonous Shoreline Low Water Quality No Reflections Etc.
streams	National Importance Unusual Motion Unusual Configuration High Water Quality Etc.	Moderate Importance Common Motions Common Configuration Average Water Quality Etc.	Minimal Importance Still Montonous Configuration Low Water Quality Etc.
Vegetation	National Importance Unusual Stand Size Unusual Texture Unusual Seasonal Color Unusual Forms Etc.	Moderate Importance Common Stand Size Common Texture Moderate Seasonal Color Common Forms Etc.	Minimal Importance Minimal Stand Size Monotonous Texture No Seasonal Color Monotonous Forms Etc.
Combinat tions of Features	High Contrast		Monotony

LAKES

A listing of the lakes and some of the data relative to their size and depth is provided in Appendix Table 1. There is, however, considerable in-depth study yet to be done regarding the trend of the lakes (life expectancy), quality of the waters, and sensitivity to use. A qualified limnologist could contribute the needed data important to the management of this resource.

PART II

Discussion of Mapping Units Which Include
Geomorphic Feature, Plant Community, Wildlife,
and Visual Resource Descriptions and Interpretations

A. Introduction

In this section, a description of each mapping unit with its geomorphic features and physical characteristics, associated plant community(ies), wildlife species, and visual resources can be found. Factors important to management of these units of land are also listed. Following this narrative description are photographs of typical sites, and tables of interpretation for each mapping unit. Each table of interpretation lists the different facilities or activities (i.e., road construction, horse cross-country travel, etc.) which might occur on the unit. The major considerations or limitations that the geomorphic feature, plant community, wildlife or visual resource has upon the facility, use, or activity is briefly listed. To aid the planning team, some possible alternatives or treatments are given to overcome these limitations or considerations. These are a guide or sampling of some alternatives which could be considered and are not intended to be absolute or the only alternatives or treatments. Possible negative results from the specific alternatives or treatments are also given where applicable.

Delineations which encompassed similar geomorphic features, (landforms of similar development or erosional processes), plant communities and the related wildlife habitats were made on aerial photographs. In some cases, a mapping unit has an exclusive plant community; in others the mapping unit has two or more plant communities; or in some instances, a specific plant community grows on different mapping units. Wildlife species are more closely related to the plant communities to the geomorphic features. The delineated areas were coded and briefly described as to their physical characteristics. These, then, served as a basis, or point of reference, for all resource data collection and interpretations. Interpretations important to the management and recreational development of the area were based on an understanding of the processes and interrelationship of the sand supply, shoreline and dune topography, climatic regime, permanent and seasonal water table, vegetation, and wildlife.

In the process of making interpretations, a variety of man-caused activities, facilities or uses were observed, cause and effect relationships were established, and the interpretation and/or predictions of man's activities were then made. Three rating systems for each expected activity, facility, or use, such as road construction or campground developments, were then developed through the observations, interpretations and knowledge of each of the specialists involved.

<u>The physical suitability ratings</u> are based on the physical ability of the geomorphic feature and plant community to absorb the impact of a specific activity, use, or facility. <u>The tolerance ratings</u> are based on the ability of the wildlife or visual resource to withstand the impact of a specific facility and/or man's influence.

These ratings range from 1 (most suitable or most tolerant) to 5 (least suitable or least tolerant).

B. Activity, Facility or Use Elements, Column 1:

1. Road Construction: This is a consideration of the effect of a road upon the land. A double-lane width, hard-surfaced road, resting on a minimal ballast import (5") and/or minimal culvert spacing and designed on less than 4 percent gradient was considered as a standard.

   "Turnpiking" was not considered as basic design but is recognized later as an "alternative or treatment" since it represents added road construction and design costs.

2. Parking Lots: This facility is defined as having paved spaces for no more than 50 cars. In addition to the effect which the parking lot has on the land, the reverse was also considered. Wind direction, deposition, submergence, erosion, etc., were factors that were recognized.

   Parking lots increase people concentrations on adjacent areas. This is reflected by the Human Occupancy - Day Use Activity. Both must be considered when determining the effect of a parking lot.

3. Drainfields: Specifications for drainfields established by county, State and Federal regulations served as the basis for this facility evaluation. Water tables, bedrock and/or impervious layers in excess of 8 feet below the surface were considered as suitable conditions. The contamination hazard of the ground water reservoir or estuary was also considered. It should be emphasized that this facility requires intensive onsite investigations beyond the scope of this inventory.

4. Campgrounds: This facility is defined as an overnite recreation development, exclusive of sanitation features or buildings. Natural vegetation protection and maintenance were also recognized where they applied. Plantings were considered as an "alternative or treatment." The measure of man's influence becomes the impact created by 15 people per acre during a time period of 4 hours or more.

5. Human Occupancy - Day Use: This considers concentrated day use activities and their impact on the land, waters and related resources. The measure of man's influence becomes the impact created by 50 or more people/acre during active period of 1 to 4 hours.

6. Human Occupancy - Pedestrian Access: The impact of pedestrian access, from one point to another, including cross-country and/or trail traffic, and dispersed activity was considered here. The measure becomes the impact created by 5 people per acre during the time period of 1 to 5 hours.

7. Cross-country Travel - Horses: This is defined as saddle horse movement from one point to another. "Trailing" can be expected in the densely vegetated and steeper portions of the area, while dispersion can be expected in the open sand and possibly the deflation plain areas. Where "trailing" was expected, notations were made on each geomorphic-plant community type.

8. Cross-country Travel - Vehicles: It is defined as vehicle movement (particularly Dune Buggies) from one point to another. The tendency for trailing was recognized. The establishment of trails through sensitive or densely vegetated areas was considered only as an alternative or treatment.

9. Buildings, Continuous Foundation: These are defined as being one-story, wood frame structures secured to a concrete or similar foundation.

10. Buildings, Pole Foundation: These are defined as being similar to above except secured to poles or stilts.

11. Powerline Tower Installations: This facility considered the clearing swath necessary (60-80' width), erosional status, service road, and the foundation capabilities of the soil mantle.

12. Buried Pipeline Installations: This facility considered all subsurface utility installations including water, electricity (up to 38,000 volts) and sewage. Water table levels, salt water erosion, clearing swaths (60-80' width) erosional status of the soil mantle and service road were considered.

13. Vegetative Stabilization: This facility was considered as an area suitable for "dune grass" plantations, which includes the European beachgrass, scotch broom and shorepine species.

C. Considerations and Limitations, Column 2: This column includes brief statements of the naturally occurring conditions which act as limitations to the specific activities, facilities, or uses. Recreational opportunities, such as viewing wildlife, where applicable, are also listed.

Some of the conditions mentioned are severe limitations or constraints, while others can be overcome by increased construction costs, engineering expertise, or maintenance, etc. The rating value in Column 3, provides an overall evaluation of the degree of severity of the conditions listed based on the physical resource. The rating values in columns 4 and 5 indicate the degree of severity of the conditions listed based on the wildlife or visual resource.

D. Physical Suitability Ratings, Column 3:

All physical suitability ratings were based on a projected 10-year period, including expected visitor use, average climatic events, and the usual level of man-caused impact to the soil and native plant resources

within the limits of reasonable use. All ratings were based on the physical resource considerations, only.

Most Suitable . . . . Least Suitable

1 5

At the "most" suitable end of the range, it was felt that no severe or irreversible resource damage would occur as the result of a specific activity.

At the "least" suitable end of the scale:

1. Additional or sophisticated treatment measures would need to be employed to protect the site or prevent excessive damage to the resource, or

2. The site is too sensitive to survive without incurring irreversible damage, or

3. Damages to the improvement or facility could be expected.

<u>The "least suitable" rating is not meant to be construed as "impossible" but only serves as the means to "red-flag" certain activities.</u>

E. <u>Wildlife Tolerance Ratings, Column 4:</u>

The tolerance rating for wildlife indicates the impacts a proposed facility(ies) and/or activity(ies) would have on the wildlife species utilizing a habitat. The tolerance rating was assigned to the habitat type (the unit with which the land manager works). The tolerance ratings range from 1 (no significant effect on wildlife anticipated) to 5 (a significant detrimental effect on wildlife).

The following major considerations were used to develop the tolerance ratings:

1. The nature, magnitude and trends in present and anticipated recreational use of the Oregon Coast and N.R.A. A 5-percent average annual rate of increase (probably a minimal estimate) in recreational use of the N.R.A. was anticipated during the next 10 years.

2. The acreage, shape, and location of habitat types.

3. The life histories and behavior of wildlife species utilizing the habitats, especially endangered, rare and unique species. Tolerance ratings of 5 and 4 emphasize the need to (1) avoid the development of recreational facilities in all or certain portions of these habitats, (2) limit the type and magnitude of recreational use these habitats receive, and (3) develop sophisticated treatments and procedures when it becomes absolutely necessary to develop portions of these habitat types (work closely with wildlife biologist on a case-by-case basis).

F. Visual Tolerance Ratings, Column 5:

The tolerance ratings for the visual resource indicates the anticipated impact of proposed facilities or activities on the characteristic landscape. The entire N.R.A. is used as a base of reference. The impacts the proposed facility or activity would have on the dominant factors (form, line, texture, color and in some cases, motion) were considered. The degree of visual harmony a facility or activity has with the dominant features of the characteristic landscape is rated on a scale of 1 (generally compatible with the characteristic landscape) to 5 (starkly incongruous with the dominant features of the characteristic landscape).

G. Some Alternatives or Treatments, Column 6:

Listed here, as a guide, are some possible alternatives or treatments that correspond to the limitations and considerations listed in Column 2.

H. Possible Negative Results, Column 7:

These are the expected negative results of the alternatives or treatments listed in Column 6. Where the results are unknown, a question mark is used. In those cases where no particular negative results are expected, a dashed line is used.

MAPPING UNIT LEGEND

Map Symbol	Description
FD	Foredune
HWS	Hummocks, Occ. Wet, Stabilized
HW	Hummocks, Occ. Wet
HA	Hummocks, Dry
DG	Deflation Plain; grasses, rushes and sedges
DGL	Deflation Plain; low shrubs
DT	Deflation Plain; tall shrub thicket
DST	Deflation Plain; shorepine forest
TW	Transverse Ridge, Occ. Wet
TDA	Transverse Ridge, Dry
OA	Oblique Ridge System
PA	Parabola, Active
DS/TF	Stabilized Dune Surface; transition forest
DS/TFO	Stabilized Dune Surface; transition forest, old-growth
DS/TFC	Stabilized Dune Surface; transition forest, clearcut, 2-12 years
DS/TFS	Stabilized Dune Surface; transition forest, second-growth, 12-50 yrs.
DS/SFR	Stabilized Dune Surface; shorepine forest of stabilized dunes
DSA/TF	Stabilized Dune Surface, Eroding; transition forest
DSA/TFS	Stabilized Dune Surface, Eroding; transition forest, second-growth
DSA/SFR	Stabilized Dune Surface, Eroding; shorepine forest of stabilized dunes
PRS/TF	Precipitation Ridge - Slip Face; transition forest
PRS/SFR	Precipitation Ridge - Slip Face; shorepine forest of stabilized dunes
PRA	Precipitation Ridge - Active Slip Face
PRX	Precipitation Ridge - Active Slip Face, Threatening
SC	Conditionally Stable Slip Face
RS	Rolling, Partially Stabilized Dune Surface
FA	Flood Plain, Active
FA/SM	Flood Plain, Active; salt marsh - meadow
FS/SFR	Flood Plain, Stabilized; shorepine forest of stabilized dunes
FS/TF	Flood Plain, Stabilized; transition forest
MSM	Mountain Front; shoreline marsh
MMV	Mountain Front: marshy valley fill
MDW	Mountain Front; narrow drainageway
MSS/TF	Mountain Front, Steep side slope; transition forest
MSS/TFO	Mountain Front; Steep side slope; transition forest, old-growth
MSS/TFC	Mountain Front, Steep side slope; transition forest, clearcut
MSS/TFS	Mountain Front, Steep side slope; transition forest, second-growth
MTL/TFS	Mountain Front, Tableland; transition forest, second-growth
\!/	Marsh
L or Lake	Lakes and Ponds
	Beach
Named	Rivers and stream courses
PLANT	Plantations, with years since planted
	Land-use boundary
	Gradation boundary between plant communities
	Approximate N.R.A. boundary
	Mass movement, headwall escarpment

Foredune (FD): This relatively young landform appears to have been influenced by man's activities and has developed within the past 40 years. It is in a slightly aggrading state (building slowly) and is dependent largely on driftwood from winter winds for its foundation, littoral drift and summer winds for its maintenance and enlargement, and introduced beachgrass for its protection against winter storms. It comprises approximately 1.5 percent of the total area.

European beachgrass, introduced in the last century, has been planted or naturally spread all along the Oregon Coast. It grows best where sand deposition is greatest (the immediate shore area) and its sand-trapping effect drastically reduces the amount of sand moving inland from the beach. In one sense, it protects the inland or dunes area from storms, debris, etc., while in another and larger sense, it is the major causative effect responsible for the stabilization and ultimate diminishment of the open sands.

The foredune is convex in shape and includes trough-like features which are quite uneven or hummocky. The water table is usually more than 5 feet below the ground surface. Slope gradients range from nearly vertical on the seaward side, to nearly level on the top. General slope range, however, is about 20 to 30 percent, with a vertical relief of 20 to 25 feet, and a horizontal distance across the base of 50 to 75 feet. This feature blends into and is associated with the areas delineated as hummocks, occasionally wet, stabilized (HWS) but is considered separately for specific purposes such as different use and management. The largest foredunes appear in the northern portion, and there is an extending or progressing process taking place on the north side of the river outlets (except at Florence), while the south side is being destroyed. This phenomenon is related to the longshore currents, which are most effective in the summer.

Pure Beachgrass Community: This community is situated typically on the windward side of the foredune where there is constant sand deposition and in hummocks where there is an abundant sand supply. European beachgrass is the only species found growing in this area that can tolerate constant sand burial, and under these conditions it perpetuates itself in a pure community. Because of the mound building ability of beachgrass, it is usually found well above the water table.

Relatively few species of wildlife (21) use the foredune; and none are directly dependent on it. However, the foredune is parallel or adjacent to the preferred nesting area of the snowy plover. The snowy plover, considered rare in Oregon, nests in the driftwood tangle on beach and the sand spits of streams from April through June. The Oregon Dunes National Recreation Areas contain at least 27 percent of all the snowy plover habitat in Oregon.

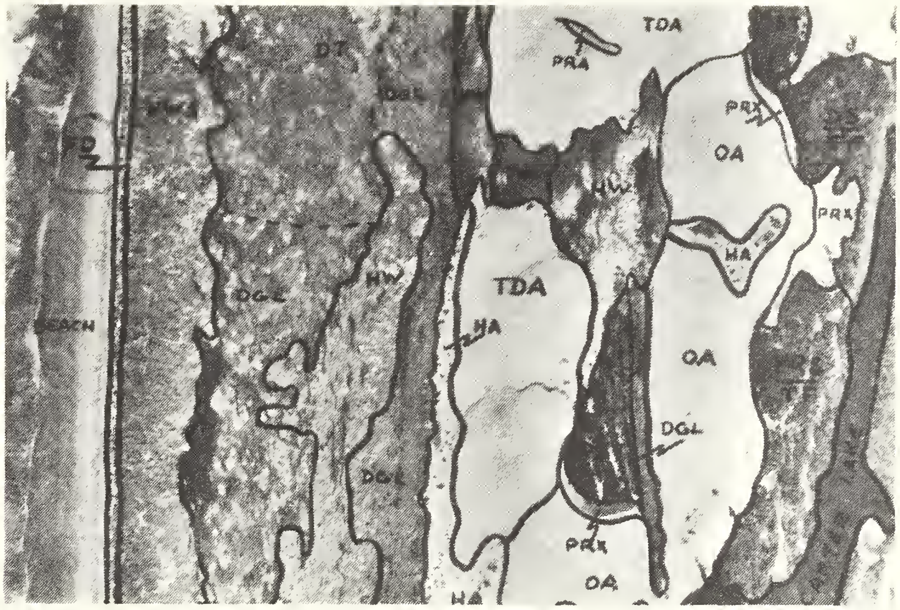
The foredune often creates a visual barrier or obstruction to persons seeking to get onto the beach. The hummocky landform and sharp tips of the beachgrass tend to constrict cross-travel so that trailing occurs. This same landform creates pockets and valleys, or troughs, which become sanctuaries from the wind, and provide a series of sheltered bases from which to migrate onto the beach. The foredune provides a natural elevated viewing platform to observe the ocean, beach, and the landforms extending inland

to the mountain front.

Some important factors to be considered in the management of the foredune are: (1) its key role as a modifier of the previous dunal process, that is, a barrier to the sand supply and ocean encroachment; (2) its vegetative sensitivity to man's trampling activities which may or not be entirely physically detrimental, but certainly aesthetically alarming; (3) its relatively permanent existence; (4) and the concept that it is a naturally acceptable portion of the seaside landscape, that is, people expect to see it; and (5) the proximity to critical nesting areas of the snowy plover.

Close-up view of eroded face of foredune. Note the various levels of log debris that supply the foundation of this feature.

View of Foredune, beach and hummocks stabilized, occ. wet (HWS). The driftwood tangle adjacent to the Foredune is used for nesting by the snowy plover, a rare bird in Oregon.



View of the Foredune (FD) and its relationship to Hummocks; occasionally wet, stabilized (HWS) and their proximity to the Deflation Plain, low shrubs (DGL).

View of an eroded face of the Foredune.

Foredune (FD)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. "Unstable" - subject to wave erosion & log jams b. Uneven and abrupt relief - requires cuts c. Opens beach to vehicle access d. Not compatible with char. landscape e. Excessive snowy plover* harassment (rare species in State) when located parallel to beach	5	5	5	a. Riprap seaward side b. Fill depressions with ballast c. Enforce reg. & construct barriers d. None e. Locate perpendicular to beach	a. Potential for undercutting - visual impact b. Erosion on adj. areas-visual impact c. Neg. visual impact and admin. require. d. -- e. Some harassment will persist
Parking lots	a. "Unstable" b. Uneven and abrupt relief c. Inadequate size of area d. Increased airflow problem e. Not compatible with char. landscape f. Snowy plover harassment (rare species in State)	5	5	5	a. Riprap seaward side b. Fill depressions with ballast c. Landfill on inland side d. Plant larger species e. None f. None	a. Potential for undercutting persists - visual impact b. Erosion on adj. areas c. Increased runoff - neg. visual impact d. -- e. -- f. --
Drainfields	a. Slope, relief & shape unsuitable b. Inadequate size of absorption area c. Pollution hazard estuaries, ground water & wildlife	5	?	1	a. Provide vault or sew. collection system b. Landfill c. Sewage collection system	a. Disposal site limitations b. Neg. visual impact c. Disposal site limitations
Campgrounds (24 hr. occup.)	a. Neg. visual impact b. Inhospitable recreat. environ. (wind & moisture) c. Inadequate size of area d. Hazard of wave breaching e. Snowy plover* harassment (rare species in State)	5	5	5 4	a. None b. Construct artificial windscreen c. Landfill d. Riprap e. None	a. -- b. Neg. visual impact c. Extend scouring action to adj. land d. Potential for unsafe cond. persists e. --
Human Occupancy (Day use)	a. Inhospitable environment (wind & moisture) b. Low carrying capacity c. Snowy plover* harassment (rare species in State) d. Vegetation sensitive to trampling	5	5	3	a. None b. Provide reinforcement c. Identify & protect areas April-June; I&E program d. None	a. -- b. Neg. visual impact c. Reduction of recreat. land base d. --
Human Occupancy (Ped. access)	a. Vegetation sensitive to trampling b. Trail-rutting susceptible c. Low carrying capacity d. Snowy plover* harassment (rare species in State)	4	3	1	a. Provide bridging or paving b. " " " " c. " " " " d. Identify & protect areas Apr-June; I&E	a. Slight change in visual b. " " " " c. -- d. Reduction of recreation base; some harassment will persist

*The snowy plover does not use the foredune itself. It uses the driftwood tangle on the beach and the sand spits of the river and streams. Both of these areas are adjacent to the foredune. Any activity on the foredune would directly affect the snowy plover.

Foredune (FD)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-country travel (horses)	a. Low carrying capacity b. Tendency for trailing c. Trail-rutting susceptible d. Snowy plover harassment (rare species in State)	4	5	2	a. Provide bridging or pave b. " " " " c. " " " " d. Identify & protect areas Apr.-June; I&E program	a. Visual impact b. Slight change in visual c. " " " " d. Reduction of recreation base; some harassment will persist
Cross-country Travel (Vehicles)	a. Vegetation sensitive to wheel traffic b. Tendency for trailing - visual c. Snowy plover harassment (rare species in State)	5	5	4	a. Bridging b. Barrier c. Identify & protect areas April-June; I&E program	a. Negative visual impact b. Modification of visual character. c. Reduction of recreation base; some harassment will persist
Buildings (Contin. foundation)	a. "Unstable" due to wave erosion b. Sand deposition on lee side c. Wind scouring on windward side d. Not compatible with charact. landscape	5		5	a. Riprap b. Maintenance c. Plantings d. None	a. Potential for undercutting persists; visual impact b. -- c. -- d. --
Buildings (Pole foundation)	a. Not compatible with char. landscape b. "Unstable" due to wave erosion c. Highest velocity wind exposure	5		4	a. None b. Riprap c. None	a. -- b. Potential for undercutting persists; visual impact c. --
Powerline Tower Install.	a. Not compatible with char. landscape b. "Unstable" due to wave erosion c. Highest velocity wind exposure d. Excessive loss of wildlife habitat and harassment if located parallel to beach, especially snowy plover.	5	5	5	a. Buried pipe b. Riprap c. None d. None	a. -- b. Potential for undercutting persists; visual impact c. -- d. --
Buried Pipeline Install.	a. "Unstable" due to wave erosion b. Excessive loss of wildlife habitat and harassment if located parallel to beach, especially snowy plover	5	5	1	a. Riprap b. None	a. Potential for undercutting persists b. --
Vegetative Stabiliz. (dunegrass)		1		1		

Hummocks; Occasionally Wet, Stabilized (HWS): This geomorphic plant community unit is associated with and occurs behind the foredune, and due to the sand and salt air movement, provides a favorable environment for the production and maintenance of beachgrass. It is uneven in slope and shape, with an overall low relief of less than 30 feet. The water table becomes closer to the ground surface as the landform blends easterly into the adjacent deflation plain. It also blends into the back side of the foredune where its landform becomes more trough-like, and creates minor alterations of the plant community which it supports. It could be considered as part of the foredune, but was separated from it on the basis of plant communities, lack of driftwood foundation, and management implications. It comprises approximately 4.5 percent of the total area. Combined with the foredune, the two units amount to about 6 percent of the total area.

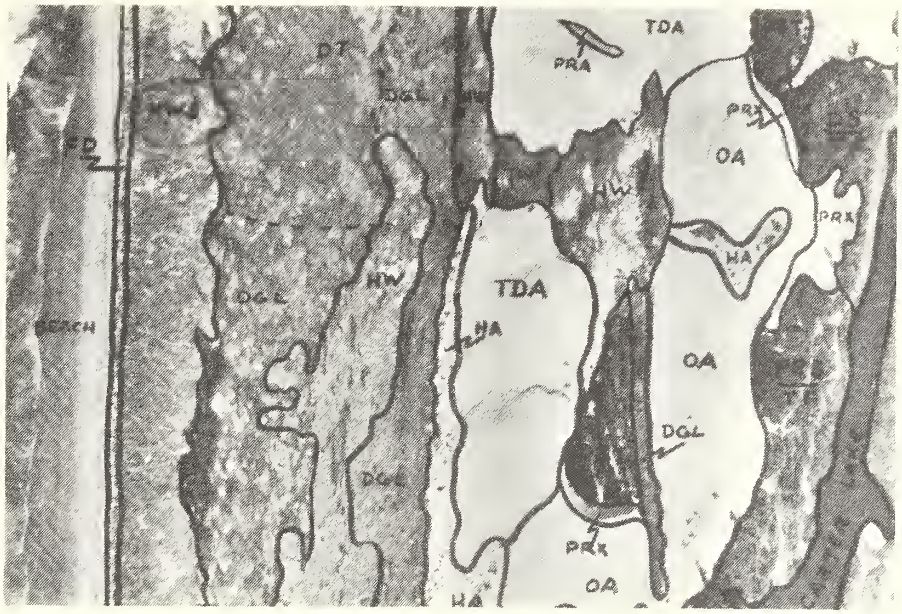
The Beachgrass Community: Found on raised areas and higher edges of the new deflation plain, and very typically on the lee side of the foredune. Also found on hummocks, formed by beachgrass, that has become stabilized because of limited supplies of sand. Sand deposition varies from very little in the more protected sites to very large amounts near the crest of the foredune where the community is principally pure beachgrass. There is no standing water on this community during even the wettest time of the year, and during the summer months the water table is several feet below the surface.

This community, with an average of eight plant species, is dominated by seashore lupine, European beachgrass, and seashore bluegrass. Found in varying amounts are: beach knotweed, beach silvertop, gray beach pea, and coast morning glory. The community has a lot of exposed ground, with a vegetative cover of 50 to 75 percent. The presence of shrub and tree seedlings is insignificant, with only dwarfed and deformed specimens found in limited abundance.

The plant community occurring on these hummocks is used by 54 species of wildlife; 37 of these species are birds. The northern alligator lizard, striped skunk, savannah saparrow and sparrow hawk are typical species of this "grassland" community.

Snowy plover nesting areas are adjacent to most of this unit.

Important factors inthe management of this unit are: (1) its proximity to and transition into the foredune and the necessity to treat both units as a whole, and (2) the proximity to snowy plover nesting areas.



View of the Hummocks; occasionally wet, stabilized (HWS) their relationship to the Foredune (FD) and the gradation into the Deflation Plain; low shrubs (DGL) and tall shrubs (DT).

View of the (HWS) showing lupine and the beachgrass clumps. These Hummocks are primarily used by song birds (23 species). Savannah and white-crowned sparrows are very common in this habitat.

Hummocks, Occ. Wet, Stable (HWS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. High water table (annual consid.) occ. flooding	2			a. Turnpike or seasonal restrictions	a. Neg. visual impact
	b. Increased turbulence & wind veloc.(effect on visitor)			5	b. Plantings on adj. areas; sand removal program	b. --
	c. Marginally compatible w/char. landscape			3	c. Design to fit landscape	c. --
	d. Alignment difficult to maintain w/o excess cuts			4	d. Low-speed roads fit to landscape	d. Safety hazard
	e. Excessive loss of wildlife habitat & harassment if parallel to beach.		5		e. Locate perpendicular to beach, restrict use Oct-May; I&E Program	e. Some loss of habitat & harassment will occur
Parking Lots	a. High water table	2			a. Land fill	a. Possible subsurface drainage impeden.
	b. Increased turbulence & wind veloc. (effect on visitor)			3	b. Plantings, on adj. acres, of wind screen species	b. --
	c. Sand deposition (onsite)				c. Sand removal program	c. --
	d. Marginally compat. with char. landscape			4	d. None	d. --
	e. Loss of habitat & harassment of wildlife		4		e. Limit number of visitors; restrict use Oct-May; I&E	e. Some habitat loss & harass.will occur
Drainfields	a. High water table	4			a. Sewage collection system	a. Disposal site limitations
	b. Ground water contamination hazard			1	b. " " "	b. " " "
	c. Pollution hazard to estuaries & deflation plain		5		c. " " "	c. " " "
Campgrounds (24-hr. occup.)	a. High water table (seasonal consid.)	4			a. Land fill	a. Slight visual impact
	b. Inhospitable environment (wind)			5	b. Construct artificial wind screens	b. Neg. visual impact
	c. Veg. sensitive to trampling				c. Barriers - plant with stronger spec	c. --
	d. Loss of habitat & harassment of wildlife		4		d. Limit number of visitors; restrict use Oct-May; I&E	d. Reduction of recreation base; some harassment will persist
Human Occupancy (Day use)	a. Veg. sensitive to trampling	4			a. Barriers, fertilization & stronger species	a. --
	b. High water table				b. Land fill	b. Slight visual impact
	c. Inhospitable environment			4	c. ?	c. --
	d. Loss of habitat & harassment of wildlife		4		d. Limit number of visitors; restrict use Oct.-May - I&E	d. Reduct. of recreat. base; some harassment will persist
Human Occupancy (Ped. access)	a. Veg. sensitive to trampling	3			a. Provide bridging or paving	a. Slight visual impact
	b. Trail rutting on steeper portions			2	b. " " "	b. " " "
	c. Wildlife harassment		2		c. I&E program	c. Some harassment will persist

Hummocks, Occ. Wet, Stable (HWS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Tendency for trailing b. Trail-rutting on steeper portions c. Vegetation sensitive to trampling d. Loss of habitat & harassment of wildlife	3	 5	2 3 3	a. Provide bridging & paving b. " " " c. " " " d. Restrict to trails; I&E; zone activity*	a. Slight visual impact b. " " " c. " " " d. Some harassment will persist
Cross-country Travel (vehicles	a. Trail-rutting on steeper portions b. Veget. sensitive to wheel traffic c. Conflict in recreat. experience d. Loss of habitat & harassment of wildlife	4	 5	3 4 4	a. Provide bridging & paving b. " " " c. Zone specific areas d. Restrict to trails;I&E;zone act.*	a. Slight visual impact b. " " " c. " " " d. Some harassment will persist
Buildings (Cont. found.)	a. High water table b. Subject to high veloc. winds & turbulence c. Wind-scouring & deposition hazard	4		 4	a. Land fill b. None c. Plantings	a. Slight visual impact b. -- c. --
Buildings (Pole found.)	a. Subject to high veloc. winds & turbulence	3		4	a. None	a. --
Powerline Tower Install	a. Not compatible with char. landscape b. Subject to salt water corrosion near estuaries c. Subject to high-veloc. wind d. Excessive loss of wildlife habitat & harassment if parallel to beach	3	 5	5	a. Buried pipe b. Buried, corros.-resistant pipe c. None d. Locate perpendicular to beach; restrict use of service road; I&E	a. Temporary destruction of wildlife habitat b. ? c. -- d. Some loss of habitat & harassment will occur
Buried Pipeline Install.	a. Subject to salt water corrosion near estuaries b. High water table c. Excessive loss of wildlife habitat & harassment if parallel to beach	3	 5	1	a. Corrosion-resistant pipe b. Pumping & corros-resistant pipe c. Locate perpendicular to beach-restrict use of service road; I&E	a. -- b. Safety hazard c. Some loss of habitat & harassment will occur
Vegetat. Stabiliz. (Dunegrass)		1		1		

*See wildlife overlays for critical habitat areas.

Hummocks; Occasionally Wet (HW): This landscape supports unique, almost grotesque, knob-like patches of beachgrass with occasional scotch broom and shorepine. The water table is usually at or near the surface during the winter months and 1 to 3 feet below the surface during the summer months. It is slightly degrading (eroding away) and scouring to the wet sand seasonally. The general landscape is uneven with a generally flat floor. Slopes range from 0 to 70 percent which includes the steeper portion of the hummocks. Vertical relief ranges from 10 to 30 feet above the deflation base, but usually less than 20 feet high with horizontal distance across the base of 20 to 30 feet. These features appear to be associated with the "tongue-hills" referred to by Cooper.

This geomorphic-plant community is usually found on the migrating, east side of the deflation plain. It comprises approximately 8.6 percent of the total area.

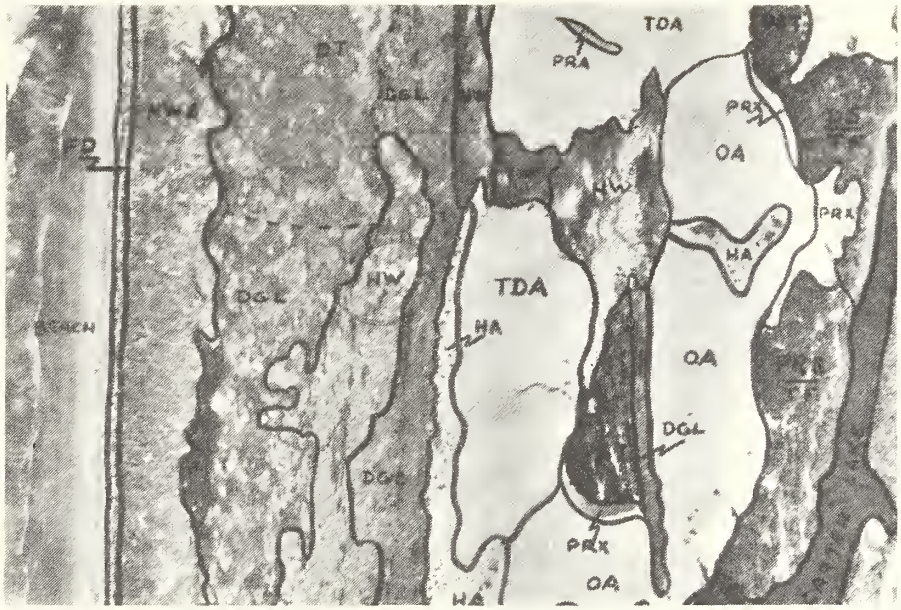
Seashore lupine, European beachgrass, seashore bluegrass and varying amounts of beach knotweed, beach silvertop, gray beachpea, and coast morning glory occur in this plant community. An occasional dwarfed or deformed shrub and tree can also be found.

This plant community is similar in plant species composition to the beachgrass community occurring on occasionally wet, stable hummocks (HWS). The major difference is plant density; the HW has a light stocking of plants.

The 54 wildlife species present in the HWS also utilize the plant community occurring on occasionally wet hummocks (HW). These species are generally present in lower densities in the HW plant community.

The shape of the hummocks and the relationship to their surroundings create an incongruous scene. In the winter months the water table rises and causes the hummocks to appear to be rising from a moat and invite a closer look to satisfy one's curiosity. They also provide a limited sanctuary from the wind and sun. Although not easily distinguishable from the dry hummocks (HA) during the summer months, wet hummocks become distinct during the winter with standing water and frequent areas of "quicksand."

Some important factors in the management of these areas are the danger of wet "quicksand-like" conditions found during the winter months, and the physical arrangement of the hummocks creates a condition of limited visibility for cross-country vehicular use.



View of the Hummocks; occasionally wet (HW) and the relationship to the Deflation Plain, low shrubs (DGL). It appears that the low shrub stage will soon invade this area.

Springtime view of the hummocks, occ. wet (HW). These landscapes have localized "quick sand" areas during highwater periods. Most of the species that utilize the HWS are also present in this habitat but in lesser abundance.

Hummocks, Occ. Wet (HW)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. High water table (annual consid.), flooding	4			a. Turnpike or seasonal restrictions	a. Slight visual impact
	b. Wind-scouring to water table level (offsite)				b. Plantings on adjacent area	b. Modification of charac. landscape
	c. Sand deposition				c. Plantings on adjacent areas & sand removal program	c. --
	d. Alignment difficult to maintain without excess. cuts			3	d. Low-speed roads; fit to landscape	d. Safety hazard
	e. Increased wind velocities & turbulence (effect on visitor)			3	e. Wind-screen plantings on adj. areas	e. --
	f. Excessive loss of wildlife habitat & harassment when located parallel to beach *		5		f. Locate perpendicular to beach; I&E program	f. Some loss of habitat & harassment will occur
Parking Lots	a. High water table (annual consid.), flooding	4		3	a. Landfill	a. Medium visual impact
	b. Increased wind velocities & turbulence (effect on visitor)			3	b. Wind-screen plantings	b. Change in characteristic landscape
	c. Wind-scouring hazard (offsite)				c. Plantings on adjacent areas	c. --
	d. Sand deposition (onsite)				d. Sand removal program	d. --
	e. Loss of habitat & harassment of wildlife		3		e. Limit number of visitors; I&E	e. Some habitat loss & harass.will occur
Drain-fields	a. High water table	5		1	a. Sewage collection system	a. Disposal site limitation
	b. Ground water contamination hazard				b. " " "	b. " " "
	c. Pollution hazard to estuaries		5		c. " " "	c. " " "
	d. "Quicksand" areas				d. None	d. --
Camp-grounds (24-hr. occup.)	a. High water table (annual consid.), flooding	5		3	a. Landfill	a. Slight visual impact
	b. Veg. sensitive to trampling (on hummocks)				b. Barriers; plant hardier species, fertilize	b. --
	c."Quicksand" areas				c. Signing; seasonal restrictions	c. --
	d. Inhospitable environment (wind)			4	d. Construct artificial wind screens	d. Slight visual impact
	e. Loss of habitat & harassment of wildlife		3		e. Limit number of visitors; I&E	e. Some habitat loss & harassment will occur
Human Occupancy (day-use)	a. Veg. on hummocks sensitive to trampling	4			a. Barriers; plant hardier species, fertilize	a. --
	b. High water table (annual consid.), flooding				b. Landfill	b. Slight visual impact
	c. Inhospitable environment (wind and water)			3	c. Construct artificial wind screens	c. " " "
	d. "Quicksand" areas				d. Signing; seasonal restrictions	d. --
	e. Loss of habitat & harassment of wildlife		3		e. Limit number of visitors; I&E	e. Some habitat loss & harass.will occur
Human Occupancy (Ped. access)	a. Quicksand areas	2			a. Signing; seasonal restrictions	a. --
	b. Veg. on hummocks sensitive to trampling			1	b. Barriers; plant hardier species, fertilize	b. --
	c. High water table				c. Bridging or seasonal restriction	c. --
	d. Harassment of wildlife				d. I&E program	d. Some harassment will persist

* See wildlife overlays for critical habitat areas.

Hummocks, Occ. Wet (HW)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Seasonal high water table b. "Quicksand" areas c. Veg. on hummocks sensitive to trampling d. Loss of habitat & harassment of wildlife	2	3	1	a. Seasonal restriction b. Signing; seasonal restriction c. Barriers d. Restrict to trails; I&E. Zone* activity	a. -- b. Maintenance c. " d. Reduct. of rec. land base; some harassment will persist
Cross-country Travel (vehicles)	a. Seasonal high water table b. "Quicksand" areas c. Loss of habitat & harassment of wildlife	2	3	2	a. Seasonal restriction b. Signing; seasonal restriction c. Restrict to trails; I&E. Zone activity *	a. -- b. Maintenance c. Reduct.of rec. land base; some harassment will persist
Buildings (Contin. found.)	a. High water table b. Wind-scouring hazard & sand deposition c. Subject to high velocity winds & turbulence d. Marginally compatible w/charac. landscape	5		4	a. Landfill b. Plantings & sand removal program c. None d. Design to fit landscape	a. Modification of charac. landscape b. -- c. -- d. --
Buildings (Pole found.)	a. Subject to high velocity winds & turbulence b. Marginally compatible w/charac. landscape	4		3	a. None b. Design to fit landscape	a. -- b. --
Powerline Tower Install.)	a. High water table b. Quicksand area c. Not compatible w/charac. landscape d. Excessive loss of wildlife habitat & harassment if parallel to beach	4	5	4	a. Buried pipeline b. None c. Buried pipeline d. Locate perpendicular to beach; I&E	a. -- b. -- c. -- d. Some loss of habitat & harassment will occur
Buried Pipeline Install.)	a. High water table b. "Quicksand areas" c. Excessive loss of wildlife habitat & harassment if parallel to beach	3	5	1	a. Pumping, corros. resist. pipe b. None or avoid c. Locate perpendicular to beach; I&E	a. Safety hazard b. -- c. Some loss of habitat & harassment will occur
Vegeta. Stabiliz. (dunegrass)	a. Lack of nutrients on hummocky portion	2		1	a. Fertilize	a. --

* See Wildlife overlays for critical habitat areas.

Hummocks; Dry (HA): An example of this unit can be found adjacent to Goose Pasture. It is characterized by having large expanses of open sand, with isolated hummocks and beachgrass. In some areas, pioneer grass species are becoming established, while in other areas, the unit appears to be eroding away. Generally, in the winter period, the water table is below the ground surface, but wet areas are not uncommon. The shape and relief are very similar to those hummocky areas on the easterly fringe of the deflation plain. It comprises approximately 3.5 percent of the total area.

Seashore lupine, European beachgrass and seashore bluegrass are dominant species on this unit but beach knotweed, beach silvertop, gray beachpea and coast morning glory also occur. An occasional dwarfed and deformed shrub or tree can also be found. In some areas, these sites will be reduced to progress toward the deflation plain conditions, while in a few locations, the trend is toward natural stabilization as described in Rolling, Partially Stabilized Dune Surfaces (RS).

Forty-seven species of wildlife use the plant community occurring on dry hummocks. The majority (34) of these species are birds. The California ground squirrel, striped skunk, savannah sparrow and sparrow hawk are common animals in this plant community.

Since the hummocks are normally associated with open sand areas, they create a visual contrast, causing a desire to venture into them for curiosity's sake. They also provide temporary stopovers and a shelter from the wind and sun associated with open-sand travel. In addition, they also offer a vantage point from which to regain one's bearings when looking about the terrain.

An important factor in the management of these areas is to recognize the inability of the vegetation to withstand man's activities.

View of representative Hummocks, dry (HA) which have been periodically attacked by the seasonal winds. In this area it lacks the "tongue-hills" appearance found around Goose Pasture.

View of Hummocks, dry (HA), with occasional clumps of beach grass. Dry Hummocks are used by 47 species of wildlife. None of the wildlife species are abundant and their use of the area is light.

Hummocks, Dry (HA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Wind-scouring hazard (offsite)	4			a. Plantings on adjacent areas	a. Reduction of open sand areas
	b. Undulating relief; requires cuts				b. Balanced cut & fill to fit landsc.	b. --
	c. Marginally compatible with characteristic landsc			2	c. Design to fit landscape	c. --
	d. Occas. areas of high water table & flooding				d. Fill; seasonal closure	d. Reduced recreation opportunities
	e. Sand deposition (onsite)				e. Sand removal program	e. --
	f. Increased wind velocities & turbulence (effect on visitor)			3	f. Windscreen plantings on adj. areas	f. ?
	g. Some loss of wildlife habitat & harassment		3		g. None	g. --
Parking Lots	a. Increased wind veloc. (effect on visitors)	4			a. Plantings, on adj. areas of windscreen species	a. Reduction of open sand areas
	b. Sand deposition (onsite)				b. Sand removal program	b. " " " " "
	c. Creates runoff area & wind-scouring (offsite)			3	c. Plantings on adjacent areas	c. " " " " "
	d. Marginally compatible with charac. landscape				d. Design to fit landscape	d. " " " " "
	e. Occasional area of high water table & flooding				e. Land fill	e. --
	f. Loss of habitat & harassment of wildlife		2		f. Limit number of visitors; I&E prog.	f. Some habitat loss & harass. will occur
Drainfields	a. Wind-scouring hazard	5		1	a. Plantings	a. Reduction of open sand areas
	b. Ground water contamin. hazard-some locations		1		b. Fill 6-12'	b. Visual impact
Campgrounds (24-hr. occup.)	a. Veget. on hummocks sensitive to trampling	4			a. Plantings with fertilizer treatment	a. Reduction of open sand areas
	b. Harsh environment (wind)			4	b. Construct artificial windscreens	b. Negative visual impact
	c. Wind-scouring hazard & sand deposition				c. Plantings & sand removal program	c. Reduction of open sand areas
	d. Loss of habitat & harassment of wildlife		2		d. Limit number of visitors; I&E prog.	d. Some habitat loss & harass. will occur
Human Occupancy (day use)	a. Veget. on hummocks sensitive to trampling	3			a. Barriers, plantings	a. Reduction of open sand areas
	b. Wind-scouring hazard & sand deposition				b. Plantings & sand removal program	b. " " " " "
	c. Inhospitable environment (wind)			3	c. Construct artifical windscreen	c. Negative visual impact
	d. Low carrying capacity (whole area)				d. Restrict numbers of visitors	d. Administrative problem
	e. Loss of habitat & harassment of wildlife		2		e. Limit number of visitors; I&E prog.	e. Some habitat loss & harassment will occur
Human Occupancy (Ped. access)	a. Veget. on hummocks sensitive to trampling	2			a. Barriers, plantings	a. Reduction of open sand areas
	b. Trail or path-rutting suscept. on steeper port.			2	b. Plantings	b. " " " " "
	c. Some harassment of wildlife		1		c. I&E program	c. Some harassment will persist

Hummocks, dry (HA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (horses)	a. Low carrying capacity b. Tendency for trailing c. Trail-rutting on steeper portions d. Some loss of habitat & harassment of wildlife	2	2	2 3	a. Restrict numbers b. Provide paved trails c. Plantings & barriers d. Restrict to trails; I&E	a. Administrative problem b. Negative visual impact c. -- d. Reduct. of rec. landbase; some harassment will persist
Cross-country Travel (vehicles)	a. Veget. on hummocks & grassy areas sensitive to wheel traffic b. Some loss of habitat & harassment of wildlife	2	2	3	a. Barriers & paving b. Restrict to trails: I&E	a. Negative visual impact b. Reduct. of rec. land base: some harassment will persist
Buildings (Cont. found.)	a. Wind-scouring hazard & sand deposition b. Occas. area of high water table c. Subject to high velocity wind & turbulence d. Marginally compatible with charac. landscape	5		4 3	a. Plantings b. Land fill c. None d. Design to fit landscape	a. Reduction of open sand areas b. Visual impact c. -- d. --
Buildings (Pole found.)	a. Subject to high velocity winds & turbulence b. Increase wind turbulence & scouring c. Marginally compatible with charac. landscape	4		4 3	a. None b. Plantings c. Design to fit landscape	a. -- b. Reduction of open sand areas c. --
Powerline Tower Install.)	a. Not compatible with charac. landscape b. Subject to high velocity winds & turbulence c. Wind-scouring hazard & high water table d. Some loss of wildlife habitat & harassment	5	2	4	a. Buried pipeline b. None c. Plantings d. None	a. -- b. -- c. Reduction of open sand areas d. --
Buried Pipeline	a. Wind-scouring hazard b. Occas. wet area c. Clearing would accelerate deflation plain process d. Some loss of wildlife habitat; harassment	4	2	1	a. Plantings b. Pumping & corrosion-resist. pipe c. Avoid destruction of hummocky portions d. None	a. Reduction of open sand areas b. Safety hazard during construction c. -- d. --
Vegetative Stabiliz. (dune-grass)	a. Fertility & moisture lacking	2		1	a. Fertility & plant adaptab. species	a. --

Deflation Plain; Grasses, Rushes, Sedges (DG): This landscape is a product of windscouring to a (common) deflation base, generally, the local water table. It represents a level at which sand removal can no longer operate effectively. It occurs behind the foredune hummocks and supports three plant communities: grasses, rushes and sedges. It is nearly level, covered with water in the winter months, and contains areas of standing water in the summer months. This distinct plant community complex portion of the deflation plain extends for many miles in a north-south direction, and ranges from one-tenth to three-tenths of a mile in width.

The grass, rush, and sedge communities follow small changes in the topography of the deflation plain. They occur in a checkerboard-like mosaic, in units too small to be mapped individually. For mapping purposes, these three communities are lumped under one classification, DG, but here they are discussed individually.

The Grass Community: The grass community occurs on flat areas of the deflation plain where there is essentially no sand deposition. Its occurrence within the deflation plain seems to be related to the proximity of the water table. Water stands on the surface during 2 or 3 months of the year, and in the summer drops to 2 and 3 feet below the surface.

The average number of plant species in this community is 14. The important ones are: red fescue, little hairgrass, false dandelion, coast strawberry, and seashore lupine. Seashore lupine is not as important here as in the Beachgrass Community, but its occurrence reflects its wide adaptability to different conditions. Less conspicuous members are: pearly everlasting, seaside tansy, salt rush yarrow and species of bentgrass. Vegetative ground cover is approximately 80 percent, with some bare ground apparent. Shrub and tree species are found, with seedlings of shorepine being most important.

The Rush Community: The rush community grows in moist areas of the deflation plain where the water table stands on the surface for 3 or 4 months of the year, and drops in the summer to between 12 and 18 inches below the surface. Little or no sand deposition occurs on this plant community.

The rush community has an average number of 16 species. Important species with very dense growth are: brown-headed rush, sickle-leaved rush, and spring-bank clover. Other important representative species are: California aster, golden-eyed grass, Pacific willow-herb, centaury, Monkey flower, and several species of bentgrass. There is a dense plant cover of over 90 percent. As in the Grass Community, shrub and tree seedlings occur within this type with the same degree of relative importance, except that seedlings of coast willow are the most numerous species.

The Sedge Community: It is found in the wettest areas of the deflation plain. Water stands on the surface of this community for at least six months of the year, and in the summer it is only a few inches below the surface. No sand deposition is evident on this community.

This community has an average of 10 species, with slough sedge the most abundant. It forms dense mats in the very wet sites of the deflation plain.

Other good indicators of this community are: Pacific silver weed, creeping buttercup, Hind's sedge, and king's gentian. Vegetative cover 95 percent, the highest of the herbaceous communities of the new deflation plain. Occasional shrubs and small trees, especially coast willow, occur in this community.

The grass, sedge and rush plant community complex is a unique habitat used by 92 wildlife species; 78 birds, 10 mammals, 3 amphibians and 1 reptile. From November to May this habitat receives very heavy use by 36 species of waterfowl and shore birds. The whistling swan, a very unique species on the N.R.A., is dependent on this habitat. The meadowlark, marsh hawk, Townsend vole, and pacific treefrog are some other species very common in this habitat.

The sedge-rush deflation plain is not inviting to walk on if considered alone; however, when in association with other portions of the deflation plain, it becomes the path of least resistance and, therefore, provides an open route for all types of travel. It also provides an appealing visual atmosphere for the viewing or hunting of birds and waterfowl, especially the conspicuous and unique whistling swans.

Some of the factors important to management include the fluctuating high water table and its great importance as wildlife habitat. It is also emphasized that these plant communities represent a very transient stage which will be replaced by shrubs and trees. This mapping unit is part of the whole Deflation Plain which totals approximately 17 percent of the total area, and each year this figure becomes greater.

View of the Deflation Plain, grasses, rushes and sedge (DG) during springtime high water conditions. The DG is an important feeding and resting area for 36 species of shore birds and waterfowl October to May.

Deflation Plain, grasses, rushes, sedges (DG)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. High water table(annual consid.), flooding	3			a. Turnpike, seasonal restriction	a. Impede subsurface drainage; vis. impact
	b. Interference with water movement (when located perpendicular to beach)				b. Construct on causeway	b. Negative visual impact
	c. Excessive loss of wildlife habitat & harassment if located parallel to beach		5		c. Locate perpendicular to beach, I&E program	c. Some habitat loss & harassment will occur
	d. Not visually compatible			5	d. None	d. --
Parking Lots	a. High water table (annual consid), flooding	4			a. Land fill	a. Impede subsurface drainage; visual impact
	b. Not compatible with charac. landscape			5	b. None	b. --
	c. Subsurface drainage restrictions				c. Design through-flow	c. ?
	d. Loss of wildlife habitat; harassment		5		d. None	d. --
Drainfields	a. High water table (annual consid.)	5			a. Sewage collection system	a. Disposal site limitations
	b. Ground water contamination hazard			1	b. " " "	b. " " "
	c. Pollution hazard to estuaries & wildlife	5			c. " " "	c. " " "
Campgrounds (24-hr. occup.)	a. High water table (annual consid.), flooding	5			a. Land fill	a. Slight visual impact
	b. Mosquito habitat			3	b. Biological control	b. --
	c. Loss of wildlife habitat		5		c. None	c. --
	d. Inhospitable environment (wind)			4	d. Construct artifical windscreens	d. Susceptible to wind damage; modification of charac. landscape
Human Occupancy (day use)	a. High water table, (annual consid.), flooding	4			a. Land fill	a. Slight visual impact
	b. Mosquito habitat		3		b. Biological control	b. --
	c. Loss of wildlife habitat; harassment		5		c. None	c. --
	d. Modification of charac. landscape			3	d. Specialized design	d. --
Human Occupancy (Ped. access)	a. High water table, flooding (seasonal consid.)	3		2	a. Land fill or boardwalks	a. Possible negative visual impact
	b. Wildlife harassment		4		b. Restrict use Oct-May; I&E Program	b. Reduction of recreat. base; some harassment will persist

Deflation Plain, grasses, rushes, sedges (DG)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. High water table, flooding (seasonal consid.) b. Wildlife harassment	3	4	2	a. Seasonal restriction b. Restrict use Oct-May; confine to estab. trails; I&E	a. -- b. Reduction of recreation base; some harassment will persist
Cross-country Travel (vehicles)	a. High water table, flooding (seasonal consid.) b. Veg. sensitive to to wheel traffic - rutting c. Wildlife harassment	3	4	3	a. Seasonal restriction b. Confine to estab. improved trails c. Restrict use Oct-May; confine to estab. trails; I&E	a. -- b. Interference with water movement c. Reduction of recreation base; some harassment will persist
Buildings (Cont. found.)	a. High water table (annual consid.) b. Subject to high velocity winds c. Not visually compatible d. Loss of wildlife habitat & harassment	5	4	5	a. Land fill b. None c. None d. None	a. Impede subsurface drainage b. -- c. -- d. --
Buildings (Pole found.)	a. Subject to high velocity winds b. Not visually compatible c. Loss of wildlife habitat & harassment	4	4	5	a. None b. None c. None	a. -- b. -- c. --
Powerline Tower Install.	a. Not compatible with charac. landscape b. High water table c. Excessive loss of wildlife habitat if located parallel to beach; harassment	3	5	5	a. Buried pipeline b. " " c. Locate perpendicular to beach, construct July to Sept.; restrict use of service road; I&E	a. -- b. -- c. Some loss of habitat & harassment will occur
Buried Pipeline Install.	a. High water table b. Excessive loss of wildlife habitat if located parallel to beach; harassment	2	5	1	a. Pumping required - corros-resis.pipe b. Locate perpendicular to beach: construct July-Sept., restrict use of service road, I&E	a. -- b. Some loss of habitat & harassment will occur
Vegetative Stabiliz. (Dunegrass	a. Undesirable plant composition b. Loss of shorebird & waterfowl habitat by speeding up plant succession	4	5	3	a. Plant with native or adapt. species b. Plant with grasses other than beachgr	a. -- b. --

Deflation Plain - Low, Scattered Shrubs (DGL); There is no specific zone of occurrence of this plant community on the deflation plain. This unit is recognized as a successional stage of the plant communities found within the deflation plain. It follows the establishment of the beachgrass, grass, rush, and sedge herbaceous communities as a later stage in plant succession. This community is characterized by scattered shrubs and tree seedlings up to 6 feet tall, along with the herbaceous communities on which the shrubs and tree seedlings became established.

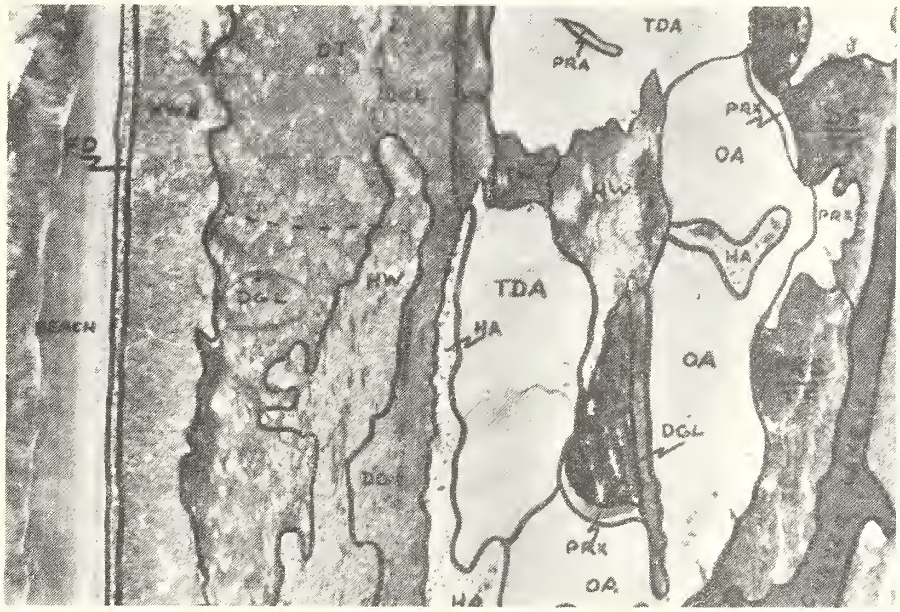
The most important shrub is willow, with salal, evergreen huckleberry, wax myrtle, and shorepine saplings following closely. Saplings of sitka spruce are present, but in very low numbers. Salal and evergreen huckleberry show a preference for drier sites, while willow and wax myrtle are most frequently found in wetter places. In contrast, shorepine saplings are found growing on both sites. There is an average of 17 species, and vegetative cover is about 95 percent. The water table is at or near the ground surface most of the year.

The low, scattered shrub plant community of the deflation plain is the habitat of 70 species of wildlife; 55 birds, 11 mammals, 3 amphibians, and 1 reptile. This area receives moderate use by 9 species of waterfowl November through May. Songbirds are very common, 33 species being present. Brush rabbits, black-tailed deer, mallard ducks, song sparrows and the pacific treefrog are common species in this habitat.

This landscape provides a visual appearance as wildlife habitat, and as such invites limited human use in an effort to gain a view of the wildlife it harbors. Generally, such use would probably be sporadic and created more by curiosity and anticipation than for any one single purpose except by groups interested in watching and studying birdlife.

Some factors important in the management of these lands include the high water table and the value as wildlife habitat.

This mapping unit is part of the whole Deflation Plain which totals approximately 17 percent of the total area.



View of Deflation Plain; low shrubs (DGL) and the transition into the tall shrub thicket (DT).

View of typical "DGL" site with willow shrubs in foreground. The DGL is the seral stage between DG and DT. Song sparrows and marsh hawks are common residents of the DGL.

Deflation Plain, low shrubs (DGL)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. High water table (annual consid), flooding b. Interference with water movement (when located perpendicular to beach) c. Excessive loss of wildlife habitat & harassment if located parallel to beach d. Not visually compatible	3	5	5	a. Turnpike, seasonal restriction b. Construct on causeway c. Locate perpendicular to beach, I&E program d. None	a. Impede subsurface drainage b. Negative visual impact c. Habitat loss & harassment will occur d. --
Parking Lots	a. High water table (annual consid.), flooding b. Not compatible with charac. landscape c. Subsurface drainage restriction d. Loss of wildlife habitat & harassment	3	4	5	a. Land fill b. None c. Design through-flow d. None	a. Impede subsurface drainage b. -- c. ? d. --
Drain-fields	a. High water table (annual consid.) b. Ground water contamination hazard c. Pollution hazard to estuaries & wildlife	5	5	2	a. Sewage collection system b. " " " c. " " "	a. Disposal site limitations b. " " " c. " " "
Campgrounds (24-hr. occup.)	a. High water table (annual consid.), flooding b. Mosquito habitat c. Loss of wildlife habitat & harassment d. Inhospitable environment (wind)	4	4	4	a. Land fill b. Biological control c. None d. Construct windscreen	a. Slight visual impact b. -- c. -- d. Susceptibility to wind damage
Human Occup. (day use)	a. High water table (annual consid.), flooding b. Mosquito habit c. Loss of wildlife habitat; harassment	3	4	3	a. Land fill b. Biological control c. None	a. Slight visual impact b. -- c. --
Human Occup. (ped. access)	a. High water table, flooding (seasonal consid.) b. Wildlife harassment	2	3	2	a. Land fill or boardwalks b. Restrict use certain areas Oct-May, I&E program	a. Possible negative visual impact b. Reduction of recreation base; some harassment will persist

Deflation Plain, low shrubs(DGL)

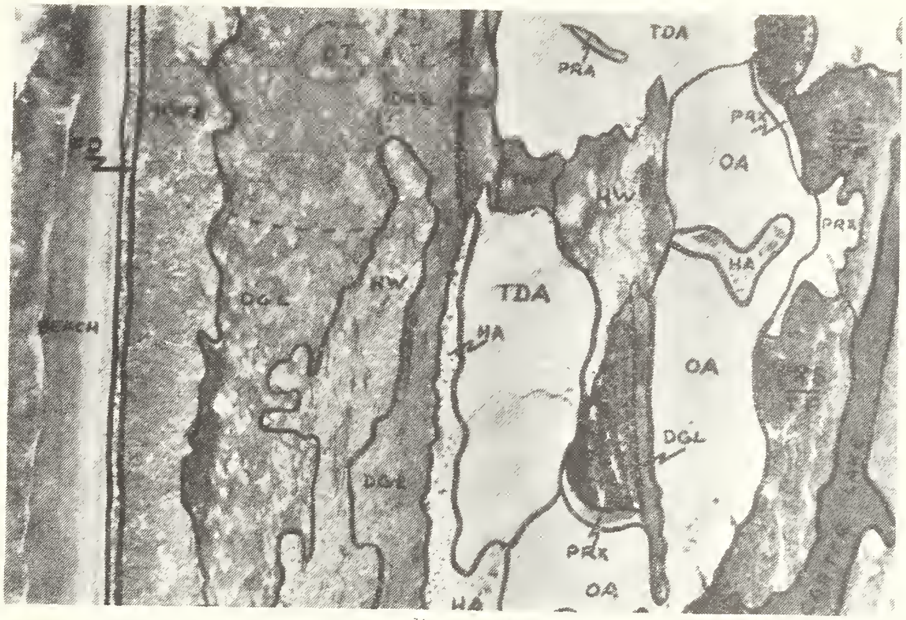
Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. High water table, flooding (seasonal consid.) b. Wildlife harassment	2	3	2	a. Seasonal restriction b. Restrict use of certain areas Oct-May; confine use to estab. trails; I&E program	a. -- b. Reduction of recreation base; some harassment will persist
Cross-country Travel (vehicles)	a. High water table, flooding (seasonal consid.) b. Vegetation sensitive to wheel traffic-rutting c. Wildlife harassment	3	4	3	a. Seasonal restrictions b. Confine to established, improved trails c. Restrict use of certain areas Oct-May; confine to est. trails; I&E	a. -- b. Interference with water movement c. Reduction of recreation base; harassment will persist
Buildings (Cont. found.)	a. High water table (annual consid.) b. Subject to high velocity winds c. Not visually compatible d. Loss of wildlife habitat	5	4	5	a. Land fill b. None c. None d. None	a. Impede subsurface drainage b. -- c. -- d. --
Buildings (Pole found.)	a. Subject to high velocity winds b. Not visually compatible c. Loss of wildlife habitat	4	4	5	a. None b. None c. None	a. -- b. -- c. --
Powerline Tower Install.	a. Not compatible with charac. landscape b. High water table c. Excessive loss of wildlife habitat if located parallel to beach; harassment	3	5	5	a. Buried pipeline b. " " c. Locate perpendicular to beach, construct July-Sept; restrict use of service road; I&E	a. -- b. -- c. - Some loss of habitat & harassment will occur
Buried Pipeline Install.	a. High water table b. Excessive loss of wildlife habitat if located parallel to beach; harassment	2	5	2	a. Pumping required corros.-resis.pipe b. Locate perpendicular to beach; construct Jul-Sept.; restrict use of service road; I&E	a. Safety hazard during construction b. Some loss of habitat & harassment will occur
Vegetat. Stabiliz. (dunegrass)	a. Undesirable plant composition b. Accelerate loss of shore-bird-waterfowl habitat by speeding up plant succession	4	5	3	a. Plant with native or adapt. species b. Plant with grasses other than beachg.	a. - b. --

Deflation Plain; Tall Shrub Thicket (DT): This plant community represents an advanced successional stage of the deflation plain. It follows the low shrub stage, with shrubs and trees ranging from 6 to 20 feet in height. Willow and wax myrtle are usually found on the wetter sites, while salal and evergreen huckleberry are on the drier sites. Shore sites indiscriminately, and is usually taller than the shrubs. Sitka spruce trees grow scattered, but are more numerous in this community than in the low shrub stage and are 2 or 3 feet taller than the surrounding vegetation. The combined canopy of shrubs and trees in this community grade from dense stands to impenetrable thickets. Many of the herbaceous species of the deflation plain communities are found growing at the edge of thickets or in openings. The water table is at or above the ground surface most of the year.

The tall shrub thicket is used by 40 species of wildlife; 29 birds, 7 mammals, 3 amphibians and 1 reptile. Most birds found in this habitat are songbirds. Black-tailed deer are very abundant in this plant community, using it for feeding and especially shelter.

This landscape provides a visual appearance as wildlife habitat, and as such invites limited human use in an effort to gain a glimpse of the wildlife it harbors. Generally, such use would be sporadic and created more by curiosity and anticipation than for any one single purpose except by groups interested in watching and studying birdlife or wildlife. The landscape does not encourage long stays due to foreshortened viewing created by the vegetation, and during the winter months it is often covered with water.

Some of the factors important in the management include the high water table, wildlife habitat and the susceptibility to pine pitch moth and western gall rust infestation. This mapping unit is part of the whole deflation plain which totals approximately 17 percent of the total area.



View of Deflation Plain; tall shrub thicket (DT) and the gradation from the low shrub community (DGL).

View from the edge of a tall shrub thicket in the Deflation Plain. Black-tailed deer use the tall shrub thicket for feeding and shelter.

Deflation Plain, tall shrub thicket (DT)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. High water table (annual consid.), flooding	3			a. Turnpike, seasonal restriction	a. Interference with subsurface drainage
	b. Interference with water movement (when located perpendicular to beach)				b. Construct on causeway	b. Slight visual impact
	c. Excessive loss of wildlife habitat & harassment if located parallel to beach		5		c. Locate perpendicular to beach; I&E Program	c. Some habitat loss & harassment will occur
	d. Questionable visual compatibility			3	d. Sensitive location & design	d. --
Parking Lots	a. High water table (annual consid.), flooding	3			a. Land fill	a. Impede subsurface drainage
	b. Marginally compatible with charac. landscape			3	b. Design & locate to fit vegetation	b. --
	c. Loss of wildlife habitat & harassment		3		c. Limit number of visitors; I&E prog.	c. Reduction of recreation base; some harassment will persist
	d. Interference with subsurface drainage				d. Design through-flow	d. ?
Drain-fields	a. High water table (annual consid.)	5			a. Sewage collection system	a. Disposal site limitations
	b. Ground water contamination hazard	5		3	b. " " "	b. " " "
	c. Pollution hazard to estuaries		5		c. " " "	c. " " "
Camp-grounds (24-hr occup.)	a. High water table (annual consid) flooding	3			a. Land fill	a. --
	b. Pine pitch moth infestation susceptibility				b. Individual tree treatment	b. Aesthetic loss
	c. Western gall rust susceptibility				c. Tree removal or treatment	c. " "
	d. Marginal recreat. envir. opportunity for wildlife viewing			3	d. Trails required	d. --
	e. Loss of wildlife habitat & harassment		3		e. Limit numbers of visitors; I&E prog.	e. Some habitat loss & harassment will occur
Human Occupancy (day use)	a. High water table	3		3	a. Land fill	a. --
	b. Mosquito habitat				b. Biological control	b. --
	c. Pine pitch moth & western gall rust & suscept.				c. Tree removal or treatment	c. Aesthetic loss
	d. Loss of wildlife habitat & harassment		3		d. None - I&E program	d. Some harassment will persist
	e. Opportunity for wildlife viewing				e. Trails required	e. --
Human Occup. (ped. access)	a. High water table (seasonal consid.)	2		2	a. Land fill	a. --
	b. Wildlife harassment		2		b. I&E Program	b. Some harassment will persist
	c. Opportunity for wildlife viewing				c. Trails required	c. --

Deflation Plain, tall shrub thicket (DT)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. High water table (seasonal consid.) b. Tendency to trail c. Wildlife harassment	2	2	2	a. Land fill b. Reinforce trails c. I&E Program	a. -- b. Slight visual impact c. Some harassment will persist
Cross-country Travel (vehicles)	a. High water table (annual consid.) b. Tendency to trail c. Wildlife harassment	4	2	4	a. Land fill b. Restrict or confine to reinforced trail c. I&E Program	a. -- b. Slight visual impact c. Some harassment will persist
Buildings (Cont. found.)	a. High water table (annual consid.) b. Subject to wind turbulence c. Marginally compatible	4		3	a. Land fill b. Utilize natural windscreening c. Design & locate to fit vegetation	a. -- b. -- c. Custom design required for each building complex
Buildings (Pole found.)	a. Subject to wind turbulence b. Marginally compatible	2		2	a. Utilize natural windscreening b. Design & locate to fit vegetation	a. -- b. Custom design each bldg. complex
Powerline Tower Install.	a. High water table b. Not compatible with charac. landscape c. Excessive loss of wildlife habitat if parallel to beach; harassment	2	5	5	a. Buried pipeline b. " " c. Locate perpendicular to beach; I&E	a. Slight visual impact b. -- c. Some habitat loss; harassment will occur
Buried Pipeline Install.	a. High water table b. Clearing required c. Excessive loss of wildlife habitat if parallel to beach	2	5	4	a. Pumping required ; corros-resis.pipe b. -- c. Locate perpendicular to beach; I&E	a. Safety hazard during construction b. -- c. Some habitat loss & harassment will occur
Vegeta. Stabil. (dunegrass)	a. Undesirable plant composition	4		3.	a. Plant with native or adapt. species	a. --

Deflation Plain, Shorepine Forest (DST): An example of this unit can be found in Goose Pasture. It is also a successional stage of the plant communities found in a deflation plain. The vegetation consists of a dense, virtually impenetrable thicket and the water table is at or near the surface most of the year.

The Shorepine Forest of the Deflation Plain: This plant community follows the establishment of the tall shrub thicket stage. In this community shorepine is the dominant tree species with some scattered spruce trees sharing the overstory. Occasionally sitka spruce occurs as almost pure stands, but this is considered a variation of the shorepine forest rather than a separate forest type. Salal and evergreen huckleberry occur sparsely as tall shrubs; willow and wax myrtle occasionally grow as trees almost as tall as the pines and spruce. The only herbaceous species found growing in the more open forest stands is slough sedge.

The shorepine forest of the deflation plain is used by 113 wildlife species; 84 birds, 22 mammals, 4 amphibians and 3 reptiles. Songbirds, 74 species, are very abundant in this habitat. Certain portions of this forest have a great number of snags which are important to cavity nesting birds and some mammals. Common animals in this habitat are the raccoons, chickaree, myrtle warbler, wrentit, and common garter snake.

Visually, it has the appearance of a dark, foreboding, and inhospitable and impenetrable thicket. The few roads and trails constructed in these areas are tightly enclosed by vegetation barriers.

Some of the factors important in the management of these lands are the high water table, wildlife habitat, and variety of plant species. This mapping unit is part of the deflation plain that comprises approximately 17 percent of the total area.

View of Deflation Plain; Shorepine Forest (DST). Note the dense overstory canopy of this particular stand.

Spring, high water period view of Deflation Plain; Shorepine Forest. Portions of the Deflation Plain, Shorepine Forest contain an abundance of snags, on which cavity nesting birds depend.

Deflation Plain, shorepine forest (DST

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. High water table (annual consid.) flooding b. Interference with water movement (when located perpendicular to beach) c. Excessive loss of wildlife habitat, especially snags, if located parallel to beach; harassment d. Modification of characteristic landscape	3	5	3	a. Turnpike; seasonal restriction b. Construct on causeway c. Locate perpendicular to beach; retain snags; I&E Program d. Alignment	a. Impede subsurface drainage; not compatible with charac. landscape b. Slight negative visual impact c. Some habitat loss & harassment will occur d. Cost, construction problems
Parking Lots	a. High water table (annual consid), flooding b. Alteration of characteristic landscape c. Loss of wildlife habitat, especially snags; harassment	3	4	4	a. Land fill b. -- c. Retain snags: limit number of parking lots; I&E Program	a. Visual impact b. -- c. Reduction of recreation base; some harassment will persist
Drainfields	a. High water table (annual consid.) b. Ground water contamination hazard c. Pollution hazard to estuaries d. Noncompatible with charac. landscape	5	5	4	a. Sewage collection system b. " " " c. " " " d. None	a. Disposal site limitations b. " " " c. " " " d. " " "
Campgrounds (24 hr. occup.)	a. High water table, flooding b. Mosquito habitat c. Loss of wildlife habitat, especially snags; harassment	3	4	3	a. Land fill b. Biological control c. Retain snags; limit number of campgrounds; I&E	a. Impede subsurface drainage; visual impact b. -- c. Reduction of recreation base; some harassment will persist
Human Occupancy (day use)	a. High water table, flooding b. Inhospitable environment c. Loss of wildlife habitat, especially snags; harassment	3	4	3	a. Land fill b. None c. Retain snags; limit number of facilities; I&E	a. Impede subsurface drainage; visual impact b. -- c. Reduction of recreation base; some harassment will persist
Human Occupancy (ped. access)	a. High water table, flooding (seasonal consid.) b. Impenetrable vegetation c. Possibility for nature trail development d. Wildlife harassment	2	1	2	a. Land fill or turnpike trails b. Paths & trails required with reinf. c. -- d. I&E Program	a. Poss. subsurface drainage interference; visual impact b. Negative visual impact c. -- d. Some harassment will persist

Deflation Plain, shorepine forest (DST)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. High water table (seasonal consid.) b. Vegetation is a natural barrier c. Wildlife harassment	2	2	2	a. Landfill or turnpike trails b. Provide reinforced trails c. I&E Program	a. Possible subsurface drainage imped.; visual impact b. -- c. Some harassment will persist
Cross-country Travel (vehicles)	a. Vegetation is a natural barrier b. Water table (annual consid.) c. Visual impacts from trailing d. Wildlife harassment	5	2	3	a. Trails required with reinforcement b. Turnpike c. -- d. I&E Program	a. Negative visual impact. b. Possible subsurface drainage impedence c. -- d. Some harassment will persist
Building (Contin. found.)	a. High water table (annual consid.) b. Slight visual impact	4		2	a. Land fill b. Custom design, careful placement	a. Visual impact b. --
Buildings (pole found.)	a. Slight visual impact	2		2	a. Custom design, careful placement	a. --
Powerline Tower Install.	a. Not compatible with charac. landscape b. High water table c. Quantity of clearing required d. Excessive loss of wildlife habitat, especially snags, if located parallel to beach; harassmnt	2	5	5	a. Buried pipe b. " " c. Fit to landscape d. Locate perpendicular to beach; retain snags; I&E	a. Slight visual impact b. -- c. -- d. Some habitat loss & harassment will occur
Buried Pipeline Install.	a. High water table b. Quantity of clearing required c. Excessive loss of wildlife habitat when located parallel to beach, especially snags	2	5	4	a. Pumping required; corros.-res.pipe b. Fit to landscape c. Locate perpendicular to beach; retain snags; I&E	a. Safety hazard during construction b. Increased construction cost c. Some habitat loss & harassment will occur
Vegetative Stabiliz. (dunegrass)	a. Undesirable plant composition	4	3	4	a. Plant with natives or adapt. species	a. --

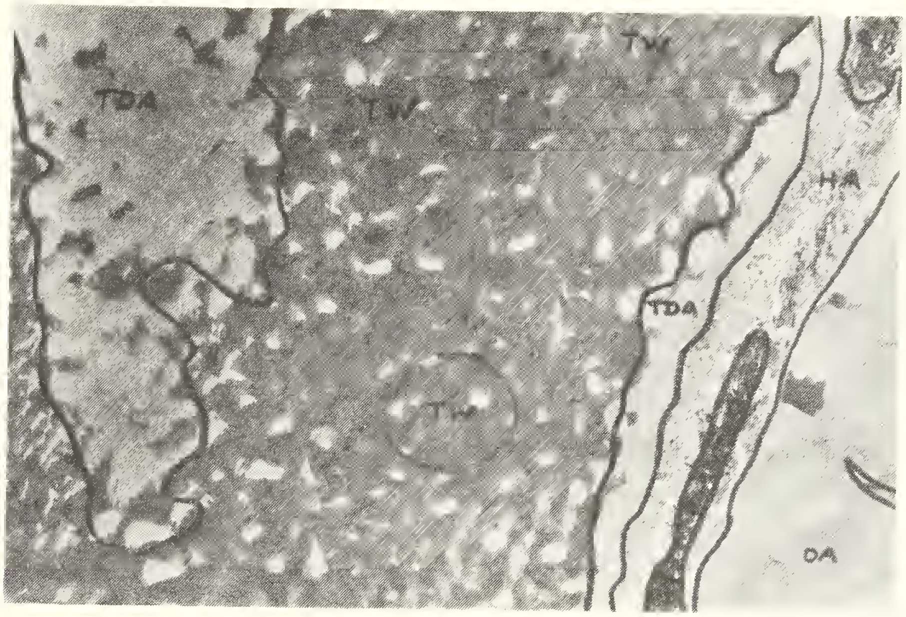
Transverse Ridge, Occasionally Wet (TW): This geomorphic feature is composed of a broad sloping ridge and a slip face. It is dynamic in nature and largely the product of summer winds. It is of low relief, 5 to 20 feet high, with slope gradient of 60 to 70 percent on the lee side or slip face. During the summer, the crest of the transverse ridges are oriented at nearly right angles to the northwest wind direction. Distances between ridges or crests vary from 75 to 100 feet and crest length is quite variable. The wavelike pattern is partly destroyed in winter due to the wind direction change and develops again the following summer. Cooper reports that these features are dependent upon unidirectional airflow, dry surface sand, sufficient sand depth, and a supply of new materials, all of which are generally provided at the expense of the deflation plain's easterly fringe. The major difference between those areas mapped as TW and those mapped as TDA (Transverse Ridge, Dry), is the occurrence of seasonal high water table and, generally, their proximity to the deflation plain.

These features do not support a plant community and are only used by wildlife when traveling to and from adjacent areas.

In many areas, the transverse ridge system forms the standard against which all other landforms are visually compared. They are extremely inviting to both pedestrian and vehicular travel; however, due to minor changes in relief, scale, or distance becomes indistinguishable, leading travelers to overextend themselves.

Some of the factors important to management of these areas include recognition that they are in a transient state (they travel as well as change in appearance) and often have "quicksand" areas along the lower edges.

These areas have a high natural appeal to the visitor. These areas comprise approximately 10.3 percent of the total area.



View of Transverse Ridges, occasionally wet (TW) taken during the winter high water table level. Note that the winter winds have softened the rippled surfaces common to the summer appearance. Some of these areas are hazardous "quick sands."

View of the Transverse Ridges, occ. wet (TW).

Transverse Dunes Occ. Wet (TW)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. High water table, (annual consid.), some flood. b. Creates increased surface runoff, ditch eros. c. Sand deposition (onsite) d. Wind scouring hazard (offsite) e. Visually incompatible f. Undulating relief requires cuts g. Subsurface drainage interfer.	5	*	 5 4 4	a. Turnpike b. Plantations, lined ditches c. Sand removal program d. Plantings e. None f. Balanced cut & fill to fit landscp. g. Drainage pipes	a. Some impedance of subsurface flow; slight visual impact b. -- c. -- d. Reduction of open sand areas e. -- f. Slight neg. visual impact g. --
Parking lots	a. Sand deposition & sand blasting (onsite) b. Wind scouring hazard (offsite) c. Not compatible w/char. landscape d. High water table, (annual consid.), some flood. e. Subsurface drainage interference	5		 5	a. Sand removal program & artif. wind screens b. Plantings c. None d. Landfill e. Drainage Pipes	a. -- b. Reduction of open sand area c. -- d. Slight neg. visual impact e. --
Drain-fields	a. High water table (annual consid.) b. Seasonally eroding or active landscape	5		1	a. Sew. collection system b. Plantings	a. Disposal site limitation b. Reduction of open sand area
Camp-grounds (24-hr. occup.)	a. Inhospitable environment (wind & moving sand) b. High water table (annual consid.) c. Seasonally eroding or active landscape d. Not compatible w/char. landscape e. Some "quicksand" areas	5		5 5	a. Construct artif. wind screens b. Landfill c. Plantings d. None e. Signing or seasonal restrict.	a. Neg. visual impact b. " " " c. Reduct. of open sand area d. -- e. --
Human Occupancy (day-use)	a. Harsh environment (wind & moving sand) b. High water table (annual consid.) c. Some "quick sand" areas d. Not compatible w/char. landscape	4		5 4	a. Construct artific. wind screens b. Landfill c. Signing or seasonal restrict. d. None	a. Neg. visual impact b. " " " c. --
Human Occupancy (Ped. access)	a. High water table (seasonal consid.) b. Some "quicksand" areas	2		1	a. Seasonal restrictions b. " " , signing	a. -- b. --

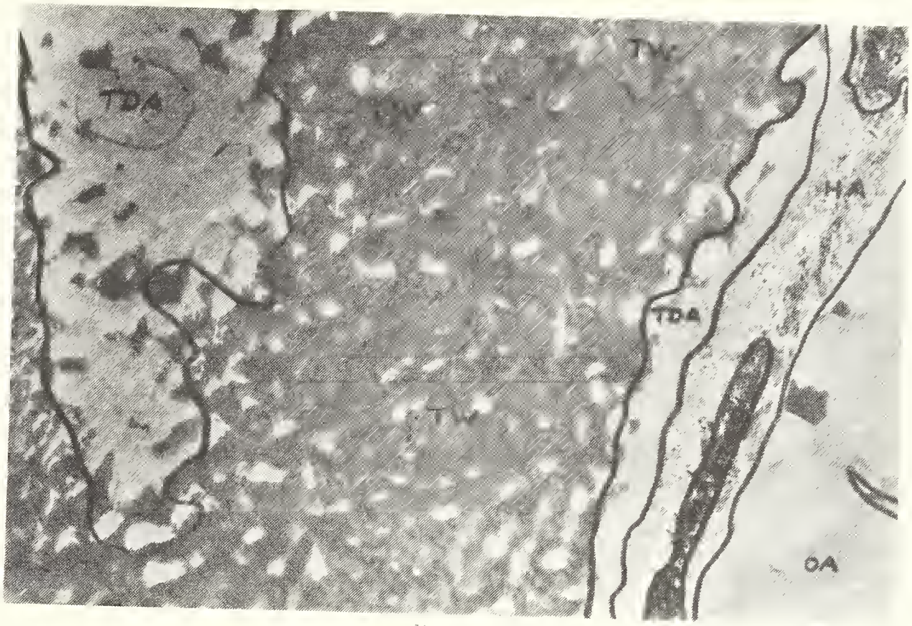
* No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units.

Transverse Dunes, Occ. Wet (TW)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (Horses)	a. High water table (seasonal consid.) b. Some "quicksand" area	2		1	a. Seasonal restrictions b. " : , signing	a. -- b. --
Cross-country Travel (Vehicles)	a. High water table (annual consid.) b. Some "quicksand" areas	2		1	a. Seasonal restriction b. " " , signing	a. -- b. --
Buildings (Contin. foundation)	a. High water table b. Subject to high wind velocities, scouring & sand blasting c. Not compatible w/char. landscape	5		5	a. Landfill b. Plantings c. None	a. Veg. visual impact b. Reduction of open sand areas c. --
Buildings (Pole Foundation)	a. Subject to high wind velocities,& sand blasting b. Not compatible w/char. landscape	4		5	a. Plantings b. None	a. Reduction of open sand areas b. --
Powerline Tower Installation	a. Wind excavation b. Some "quicksand" areas c. High water tables d. Not compatible w/char. landscape	4		5	a. Planting b. Buried pipe or avoid areas c. " ". d. " ".	a. Reduction of open sand areas b. -- c.--
Buried Pipeline Installation	a. Wind excavation b. High water table c. Some "quicksand" areas	1		1	a. Plantings b. Pumping & shoring required c. Avoid	a. Reduction of open sand areas b. Safety hazard during construction c. --
Vegetative Stabiliza. (Dunegrass)	a. Lack of nutrients b. Not compatible w/char. landscape	2		5	a. Fertiliz. b. I & E Program	a. -- b. Loss of open sand

Transverse Ridge, Dry (TDA): This geomorphic feature is composed of a sloping ridge and a slip face. It is dynamic in nature and largely the product of summer winds. It is of low relief, 5 to 20 feet high with slope gradient of 60 to 70 percent on the lee side or slip face, and 5 to 25 percent on the windward face. During the summer, the crests are oriented at right angles to the northwest wind direction, which gives it a wave-like appearance. Distances between ridges or crests vary from 75 to 150 feet, and crest length is quite variable. They become larger in an easterly direction and usually occur in "groups." The wave-like pattern is partly destroyed in the winter due to the wind direction change and develops again the following summer. Cooper reports that these features are dependent upon uni-directional airflow, dry surface sands, sufficient sand depth and a supply of new materials which are generally provided at the expense of the easterly fringe of the deflation plain or transverse ridge, occasionally wet (TW). The major differences between these areas mapped as TDA and those mapped as TW is the lack of seasonal high water table and, generally the greater distance from the deflation plain. They also blend into or capture the Oblique Ridge System (OA) and differ mostly in size and influence from wind patterns. Often these features can be seen developing on the broad ridges of the Oblique Ridge System dunes. Since these features do not support a plant community, wildlife uses them for travel to and from adjacent areas.

In many areas, the Transverse Ridge System forms the standard against which all other landforms are visually compared. They are extremely inviting to both pedestrian and vehicular travel; however, due to the small differences of relief, scale or distance becomes indistinguishable, leading travelers to over-extend themselves. These features migrate while remaining unchanged in shape and size; however, the rippled surface appearance changes from season to season. Some of the factors important to management of these areas are their scenic and recreation values. The unit comprises approximately 9.2 percent of the total area.



View of Transverse Ridges, dry (TDA) taken during the winter, high water table level. Note that even these areas have wet spots within the delineation.

Ground view of TDA, the darker or shaded portion is the slip face; note the low relief.

Transverse Dunes, Dry (TDA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Actively eroding landscape b. Wind scouring hazard (offsite) c. Increased surface runoff, ditch eros. (off-site) d. Sand deposition (on-site) e. Not compatible w/char. landscape	5	*	5	a. Planting b. " c. Planting, and lined ditch d. Sand removal progress e. None	a. Reduction of open sand area b. " " " " " c. " " " " " d. - e. -
Parking lots	a. Sand deposition (on site) b. Actively eroding landscape c. Not compatible w/char. landscape d. Increase in wind velocity and sand blasting (effect on visitor)	5		5	a. Sand removal progress b. Planting c. None d. Plantings and artif. wind screen	a. - b. Reduction of open sand area c. - d. Neg. visual impact
Drainfields	a. Wind excavation hazard b. Excessive slopes in some areas	5		1	a. Plantings b. Sew. Collection system	a. Reduction of open sand area b. Disposal site limitation
Campgrounds (24-hr. occup.)	a. Actively eroding landscape b. Inhospitable environ. (wind & sand blasting) c. Not compatible w/char. landscape d. Sand deposition (on-site)	5		5 5	a. Plantings b. Construct artif. wind screens c. None	a. Reduction of open sand area b. Neg. visual impact c. -
Human Occupancy (day-use)	a. Actively eroding landscape b. Inhospitable environ. (wind & sand blasting) c. Not compatible w/char. landscape	4		4 5	a. Plantings b. Construct artif. wind screens c. None	a. Reduction of open sand area b. Neg. visual impact c. -
Human Occupancy (Ped. access)		1		1		

* No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units.

Transverse Dunes, Dry (TDA)

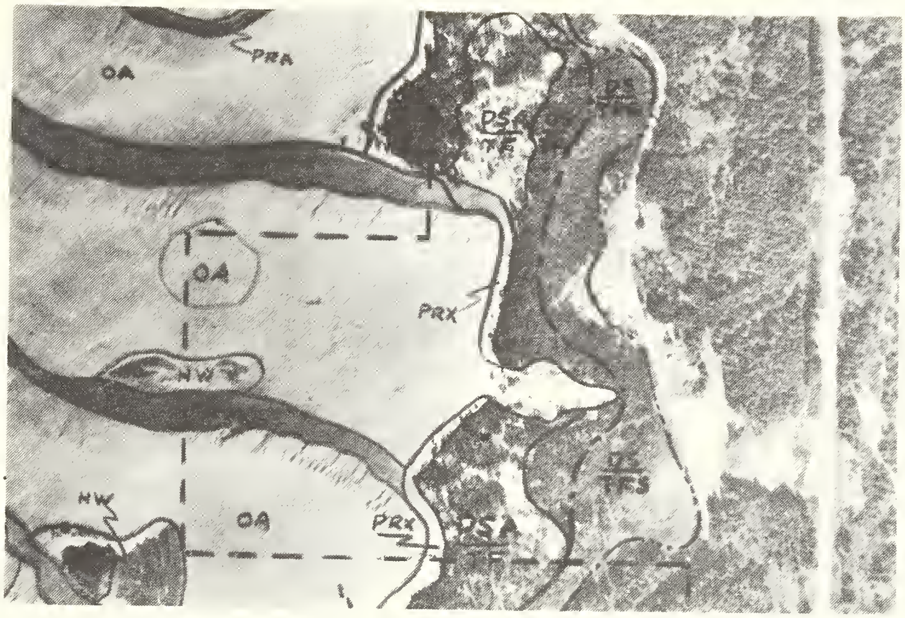
Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)		1		1		
Cross-Country Travel (Vehicles)		1		1		
Buildings (Contin. foundation)	a. Actively eroding landscape b. Creates wind turbulence (scouring & deposition) c. Not compatible w/char. landscape	5		5	a. Plantings b. Plantings & sand removal program c. None	a. Reduction of open sand area b. Reduction of open sand area c. -
Buildings (Pole Foundation)	a. Actively eroding landscape b. Creates wind turbulence (scouring) c. Not compatible w/char. landscape	4		5	a. Planting b. " c. None	a. Reduction of open sand area b. " " " " " c. -
Powerline Tower Installation	a. Wind excavation b. Not compatible w/char. landscape	5		5	a. Plantings b. Buried pipelines	a. Reduction of open sand area b. --
Buried Pipeline Installation	a. Wind excavation	2		1	a. Plantings - place below water table level	a. Reduction of open sand areas
Vegetative Stabiliza. (Dunegrass)	a. Lack of moisture & fert. b. Loss of open sand area c. Not compatible w/char. landscape	3		5	a. Fert. & possibly irrigation b. None c. I & E Program	a. -- b. -- c. Loss of open sand

Oblique Ridge System (OA): This geomorphic feature is composed of a broad, long, sloping ridge and a slip face. (The slip face is identified separately where mapping scale allows.) It is dynamic in nature and reacts to wind velocity and directional changes. It is seldom affected by water table levels and often attains heights of 180 feet, with slope gradients of 5 to 30 percent on their windward sloping sides, and 60 to 70 percent on the leeward sides, which are usually mapped as slip faces (PRA). They were named by Cooper because their crests are oriented obliquely to both northwest (summer) and southwest (winter) winds. The crest behaves as a transverse ridge but a slip face develops on alternating sides as the wind regime changes seasonally. These dunes occur in parallel series averaging some 550 feet from crest to crest. The average length is 3,600 feet with extremes up to nearly a mile. At their high inland ends, unless stabilized by plantations, they are joined by a precipitation ridge and slip face, which often is actively invading what is left of the original dune forest. The outer or seaward ends grade into the transverse ridge system which, in turn, blends into the deflation plain. These areas comprise approximately 10.2 percent of the total area.

These dynamic and spectacular features do not support a plant community. Wildlife species travel across the open sand; however, they do not reside on it.

Oblique Ridge Systems invite use by pedestrians, equestrians and vehicle operators. The associated slip face becomes prime play areas and these massive dunal features are what the public anticipates and remembers most.

It appears reasonable to predict that within the next 75 years, at the present rate of deflation plain extension, the oblique ridge system features could vanish.



View of the Oblique Ridge System (OA) and the associated Precipitation Ridge - Active Slipface (PRA) and Precipitation Ridge - Active Slipface, threatening (PRX).

Oblique Ridge system Dune in the background showing Precipitation Ridge - Active Slipface (PRA). Hummocks, dry (HA) in the immediate foreground.

Oblique Ridge System (OA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Actively eroding landscape b. Wind scouring hazard (off-site) c. Increased surface run off, ditch eros. (off-site) d. Sand deposition (on-site) e. Steep slopes, requires ext. cuts, activ. failures f. Not compatible w/char. landscape	5	*	5	a. Plantings b. Plantings c. Plantings & ditch lining d. Sand removal program e. Plantings & retaining walls f. None	a. Reduction of open sand area b. Reduction of open sand area c. Reduction of open sand area d. Reduction of open sand area e. Reduction of open sand area; visual impact f. --
Parking lots	a. Wind scouring hazard (off-site) b. Steep slopes, requires extensive excavation c. Increased surface run-off (off-site) d. Sand deposit in (on-site) e. Not compatible w/char. landscape	5		5	a. Plantings b. Plantings c. Plantings and dispersal system d. Sand removal c. None	a. Reduction of open sand area b. Reduction of open sand area c. Reduction of open sand area d. -- e. --
Drain-fields	a. Wind excavation b. Excessive slope in most locations	5		1	a. Plantings b. Sew. collection system	a. Reduction of open sand area b. Disposal site limitation
Camp-grounds (24-hr. occup.)	a. Wind scouring hazard (off-site) b. Sand deposition (on-site) c. Inhosp. environment (wind & sandblasting) d. Not compatible w/char. landscape	5		5	a. Plantings b. Sand removal program c. Construct artif. wind screens d. None	a. Reduction of open sand area b. -- c. Neg. visual impact d. --
Human Occupancy (day-use)	a. Windscouring hazard (off-site) b. Inhosp. envirn. (wind & sandblasting) c. Sand deposition (on-site) d. Not compatible w/char. landscape	5		5	a. Plantings b. Construct artif. wind screens c. Sand removal program d. None	a. Reduction of open sand area b. Neg. visual impact c. -- d. --
Human Occupancy (Ped. access)		1		1		

* No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units

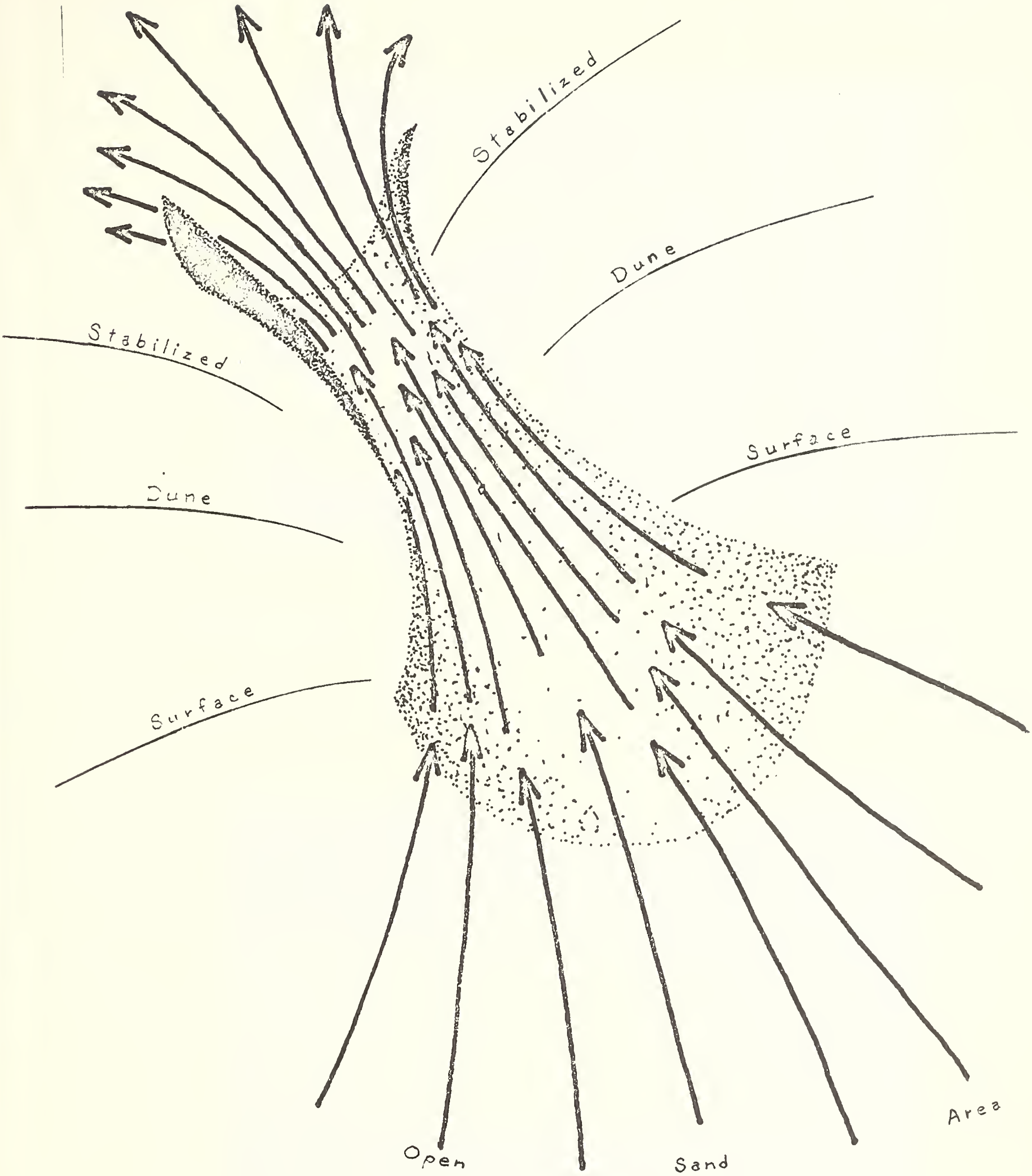
Oblique Ridge System (OA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross Country Travel (Horses)		1		1		
Cross-Country Travel (Vehicles)		1		1		
Buildings (Contin. foundation)	a. Wind excavation b. Sand deposition & scouring c. Not compatible w/char. landscape	5		5	a. Plantings b. Plantings c. None	a. Reduction of open sand area b. Reduction of open sand area c. --
Buildings (Pole Foundation)	a. Wind excavation b. Not compat. w/char landscape	5		5	a. Plantings b. None	a. Reduction of open sand area b. --
Powerline Tower Installation	a. Wind excavation b. Not compatible w/char. landscape	5		5	a. Plantings b. None	a. Reduction of open sand area b. --
Buried Pipeline Installation	a. Wind excavation b. Steep slopes - machinery limitation	4		1	a. Plantings b. Limit mach. size	a. Reduction of open sand area b. --
Vegetative Stabiliza. (Dunegrass)	a. Loss of open sand area b. Lack of moisture & fert. c. Not compatible w/char. landscape	2		5	a. None b. Fert. & possibly irrig. c. I & E Program	a. -- b. Modification of charac. landscape c. Loss of open sand area

Parabola, Active (PA): These areas of open sand are associated with vegetative areas on three sides and usually grade into Oblique Ridge System dunes (OA) on the fourth side. They are dynamic, moving and enlarging seasonally at the expense of the adjacent vegetated dune surface (DS & DSA). They are the result of a break or "blowout" in the vegetation-covered surface. When this occurs, there is often a differential resistance of the vegetation to wind and sand movement and erosion (scouring), and burial progresses more rapidly in one place than it does in another. The parabolas progress inland parallel to a unidirectional wind force and can be seen oriented to either winter winds (see photos of Clear Lake area in the discussion of sand activity) or summer wind directions. When an initial blowout occurs, the exposed sand mass enlarges somewhat laterally, but primarily longitudinally, and a form is created somewhat similar in cross section to a parabolic curve. Slopes range from 0 to 40 percent with a vertical relief of 10 to 60 feet. They are often rolling "dish-shaped" and subject to high velocity venturi-type winds. Three conditions are prerequisite for the development of a parabola: (1) a generally stabilized surface, (2) considerable thickness of sand, and (3) unidirectional, effective wind. These areas comprise approximately 1.7 percent of the total area. These active parabolas do not support plant communities. Wildlife species move across these areas when traveling to and from adjacent vegetation.

These parabolas do not invite or encourage development since they appear as a corridor of sand, boxed in by dense vegetation. They do, however, appear as an appealing walkway, linking the actively-eroding, stabilized dune surfaces. Upon closer viewing, the presence of semi-buried or excavated vegetation (some dead and grotesquely leaning) arouses the curiosity and encourages a closer examination.

Some of the factors important to mangement of these areas include the erosional process that is actively taking place, and the threatening slip face on the lee side, the strong winds generated by the natural shape or configuration.



Diagramatic sketch of a typical Parabola Dune. Unidirectional winds blowing across the open sand area are funneled into the topographic low area between stabilized dune surfaces. The narrow constriction causes a local increase in wind velocity and erosion occurs. As the wind passes out of the constriction the velocity decreases and deposition occurs forming a slip face on the lee side.

View of Parabola, active (PA) showing effect of unidirectional summer wind orientation.

Parabola (PA) in the background with Oblique Ridge system (OA) in the middle ground portion. The foreground has been eroded to the deflation base.

Parabola, active (PA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Actively eroding landscape b. Slope & relief often excessive requiring ext. cuts c. Wind scouring hazard (off-site) d. Sand deposition (on-site) e. Increased surface runoff, ditch eros. (offsite) f. Not compatible w/chan. landscape	5	*	5	a. Plantings b. Plantings c. Plantings d. Plantings e. Plantings & ditch lining f. None	a. Reduction of open sand area b. " " " " " c. " " " " " d. " " " " " e. " " " " "; f. -- slight visual impact
Parking lots	a. Actively eroding landscape b. Slope & relief often excessive, require. ext. excavator c. Increased surface run-off (off-site) d. Sand deposition (on-site) e. Wind scouring hazard (off-site) f. Not compatible w/char. landscape	5		5	a. Plantings b. " c. Plantings & Dispersal system d. Plantings e. " f. None	a. Reduction of open sand area b. " " " " " c. " " " " " d. " " " " " e. " " " " " f. --
Drain-fields	a. Wind excavation hazard b. Slope & relief excession, most locations	5		1	a. Plantings b. Sew. collection system	a. Reduction of open sand area b. Disposal site limitation
Camp-grounds (24-hr. occup.)	a. Actively eroding landscape b. Slope & relief excessive, most locations c. Harsh site (wind & sand blasting) d. Veg. on fringe sensitive to trampling e. Not compatible w/char. landscape	5		5	a. Plantings b. Locate on more than 10% slopes c. Construct artificial wind screen d. Barriers & plantings e. None	a. Reduction of open sand area b. Decrease in density, inc. in cost c. Slight Neg. visual impact d. Interference w/natural process e. --
Human Occupancy (day-use)	a. Actively eroding landscape b. Slope & relief excessive, most locations c. Harsh site (wind & sand blasting) d. Veg. on fringe sensitive to trampling e. Not compatible w/char. landscape	5		5	a. Plantings b. Locate on 10% slope c. Construct artif. wind screen d. Barriers & plantings e. None	a. Reduction of open sand area b. Decrease in density, inc. in cost c. Slight neg. visual impact d. Interference w/natural process e. --
Human Occupancy (Ped. access)	a. Veg. on fringe sensitive to trampling	1		1	a. Barriers & plantings	a. Interference w/natural process; slight visual impact

*No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units.

Parabola, active (PA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Veg. on fringe sensitive to trampling	1		1	a. Signing or barriers	a. Slight visual impact
Cross-country Travel (vehicles)	a. Veg. on fringe sensitive to trampling	1		1	a. Signing or barriers	a. Slight visual impact
Buildings (Contin. found.)	a. Actively eroding landscape b. Subject to high velocity winds (venturi effect) c. Not compatible with charac. landscape	5		5	a. Plantings b. None c. None	a. Reduction of open sand areas b. -- c. --
Buildings (Pole found.)	a. Subject to high velocity winds b. Actively eroding landscape c. Not compatible with charac. landscape	5		4	a. None b. Plantings c. None	a. -- b. Reduction of open sand areas c. --
Powerline Tower Install.	a. Actively eroding landscape (wind excavation) b. Not compatible with charac. landscape c. Burial of powerlines	5		5	a. Plantings b. None c. Plantings	a. Reduction of open sand areas b. -- c. Slight visual impact; potential sand movement acceleration
Buried Pipeline Install.	a. Actively eroding landscape (wind excavation)	5		1	a. Plantings	a. Reduction of open sand areas
Vegeta. Stabil. (Dune-grass)	a. Moisture-limiting b. Undesirable plant composition c. Not compatible with charac. landscape	3		5	a. Irrigate, possibly b. Plant with natives or adapt. species c. I&E Program	a. -- b. Modification of charac. landscape c. Loss of open sand

Stabilized Dune Surface (DS): This landform represents an older dunal surface that has been more or less stabilized by vegetative cover. It has a variety of plant communities dependent largely upon the age of the landform and position within the landform. The depth of the water table is usually greater than 3 feet, but water movement may be inhibited by older, buried marsh soils, or in the older-age forms, banding of accumulated iron which acts as a cementing agent. Depressions are also found that have a water table at or near the surface most of the year.

The shape of the land is quite variable and ranges from nearly level to 70 percent, but more commonly 10 to 30 percent. Vertical relief ranges from 20 to 70 feet within short distances, but more typically, 40-60 feet. Within these landscapes are a variety of other geomorphic features such as stabilized "saucer blowouts", parabolas, troughs that once supported lakes and marshes, old precipitation ridges and even embryonic deflation plains. All of the various gemorphic-plant communities combined total approximately 8.9 percent of the whole area.

Shorepine Forest of Stabilized Dunes (DS/SFR): This plant community is found stabilizing dune surfaces between the deflation plains and the forest type of the western foothills of the Coast Range. It occurs in pockets, as at the entrance of Siltcoos River campgrounds, or in fringes along the dunes, as in the vicinity of Threemile Lake. The dominant species of this forest type is shorepine. Occasional sitka spruce, hemlock, Douglas-fir, and western redcedar are found scattered but generally shorepine grows in almost pure stands. The very dense shrub layer has rhododendron, evergreen huckleberry, and salal as the main species. Rhododendron is the dominant understory shrub, growing as large as 10-15 feet high. Evergreen huckleberry is the second dominant tall shrub growing to 8 feet in height. Salal is found as scattered tall shrubs but it does best in openings or at the forest edge where it grows in dense stands. Other understory species are: wax myrtle, kinnikinnic, and hairy manzanita. Wax myrtle is usually associated with wetter sites and it drops out of the community on the high dune ridges. Kinnikinnic and hairy manzanita are species which grow along sheltered forest edges, protected from wind and sand deposition and receiving mostly partial sunlight. There is no herbaceous layer in this plant community.

The shorepine forest and transition forest are somewhat similar wildlife habitat types. Both have a relatively open canopy and dense shrub layer composed of the same species. In the transition forest, older and bigger sitka spruce, Douglas-fir, western redcedar and western hemlock are common. In the shorepine forest these four species only occur occasionally and they are relatively small.

The shorepine forest is inhabited by 137 species; 95 birds, 35 mammals, 4 amphibians and 3 reptiles. All of these species are found in the transition forest. Songbirds are very abundant, especially in the shrub layer. The wrentit, winter wren, olive-sided fly catcher, steller's jay and rufous humming bird are common in this habitat. Certain portions of the shorepine forest have an abundance of snags. Tree swallows, red-shafted flickers,

hairy woodpeckers and downy woodpeckers are a few species that use the cavities in snags for nesting. The red-tailed hawk, sparrow hawk and other birds of prey depend on these snags for perching sites. Common mammal species in this habitat are the brush rabbit, chickaree, and bushy-tailed woodrat. The northern alligator lizard and northwestern garter snake are common reptiles of the shorepine forest.

Transition Forest (DS/TF): This type is found along the east fringe of the big open dunes. The stand is usually open and the trees are relatively small with little commercial value. Shorepine is the most numerous tree species; scattered sitka spruce grow taller than the pines; occasional Douglas-fir, hemlock, and western redcedar trees are found scattered in the stand. This open forest has a very dense shrub layer of rhododendron, evergreen huckleberry, and salal. In moist areas there are some scattered wax myrtle shrubs.

The greatest number of wildlife species on the N.R.A. are found inhabiting the transition forest. This diversity of wildlife is a result of the unusual structure of this forest; an open canopy, a well-developed shrub layer, an abundance of snags, and trees of various ages.

The transition forest is the habitat of 145 species; 97 birds, 38 mammals, 7 amphibians and 3 reptiles. Songbirds, 84 species, are very abundant. Many of these songbirds, especially warblers, utilize the shrub layer. The rufous humming bird, wrentit, varied thrush, band-tailed pigeon, orange-crowned warbler, and olive-sided fly catcher are common in this forest. The numerous snags provide nesting sites for 22 cavity nesting species of birds. The tree swallow, downy woodpecker, screech owl, sparrow hawk and wood duck are a few species using the nesting cavities in the snags of this forest. Raccoons, flying squirrels and some bats use snags as den trees or roosting sites. Many of the 13 birds of prey, especially osprey, bald eagle, and red-tailed hawk use these snags as perching sites. The greatest number of mammal species on the N.R.A. use this habitat. The coast mole, California bat, bushy-tailed wood rat, spotted skunk, brush rabbit, and chickaree are common residents. The northern alligator lizard and northwestern garter snake are relatively common in this habitat.

Transition Forest Old Growth (DS/TFO): These are remnant stands of old-growth trees that have never been cut. The only stand of this type within the N.R.A. is at the north end of Cleawox Lake. The trees are large, attaining diameters of 3 to 4 feet. Sitka spruce and Douglas-fir are the most numerous trees in old-growth stands with occasional hemlock and western redcedar. The main shrubs of this forest type are rhododendron, salal, and evergreen huckleberry. The shrub layer is shaded out under the closed canopy of the trees, but it grows dense in openings and at the fringe of the stand.

Remnant stands of old growth are a critical habitat for certain species of wildlife. The larger birds of prey, bald eagle osprey, red-tailed hawk, and great horned owl use these stands for perching or roosting. The bald eagle and osprey are considered rare or endangered birds. While none of these species were found nesting in old growth, they all favor the large trees or snags as nesting sites. The great blue heron, a colonial nester, requires stands of large trees for nesting. An active heron rookery exists in a pocket of old growth adjacent to the southern boundary of the N.R.A.

The large trees in old-growth stands are potential snags. Snags are very important to cavity nesting birds, birds of prey and certain mammals. It may take 125 years for a tree to grow to a size suitable for nesting by great blue herons or bald eagles. An additional lengthy period of time may pass before it becomes a snag suitable for cavity nesting species. These species are dependent on the continuous availability of snags.

Old-growth stands are used by 96 species of wildlife; 55 birds, 28 mammals, 11 amphibians and 2 reptiles. Many of these species also inhabit the surrounding forest types. None of these species are abundant in stands of old growth. The eight species of salamanders found on the N.R.A. may be expected to use this habitat. The pileated woodpecker, one of the largest woodpeckers in North America, uses this habitat. Other species inhabiting stands of old growth are the hairy woodpecker, brown creeper, great horned owl, red-tailed hawk, flying squirrel, California red-backed vole and chickaree.

Transition Forest Clearcut (DS/TFC): These are logged-over stands ranging in age from 2 to 12 years. Shrub species are the undisputed dominants of the older clearcuts. Shrubs and grasses are important components of younger clearcuts and in the openings of older ones. Some of the shrubs found in clearcuts are: rhododendron, evergreen huckleberry, salal, trailing blackberry, sword fern, bracken fern, etc. Depending on the site, seed source, or planting stock, the stand will have any of the five species of trees found in the transition forest.

Clearcuts occurring in the transition forest are inhabited or used by 96 species; 61 birds, 27 mammals, 5 amphibians and 3 reptiles. The lush growth of grasses, herbs and shrubs in recent clearcuts provides an abundance of food and cover for many small mammals. Populations of deer mice, Oregon voles, Townsend chipmunks and brush rabbits increase to high levels. These small mammals attract coyotes, bobcats, great horned owls and other predators. Black-tailed deer concentrate their feeding activities in clearcuts because of the abundance of palatable browse. As the salmonberry, elderberry, huckleberry and salal shrubs mature, they start producing fruit. These berries attract bears, band-tailed pigeons, mountain quail and many species of songbirds. At approximately 12 years after logging the trees and shrubs shade out much of ground cover. Some species of small mammals deependent on this ground cover decrease in number or are eliminated. The clearcut has become a second-growth forest. Different species of wildlife now move in, replacing those eliminated by the growth of trees and shrubs. However, many species of wildlife are common to both clearcuts and young second growth.

Transition Forest Second Growth (DS/TFS): This plant community is found along U.S. Highway 101, the length of the N.R.A. The age of the stands vary from approximately 12 to 50 years since cutting and the size of the trees range from 10-foot saplings to 75-foot high trees. The overstory composition is usually a mixture of shorepine, sitka spruce, Douglas-fir, with scattered hemlock and western redcedar. In young stands, the shrub layer is an important component of this community but in older ones, the shrubs are completely shaded out. Rhododendron, salal, evergreen huckleberry, trailing blackberry, sword fern, bracken fern, etc., are the most common shrubs in second-growth forests.

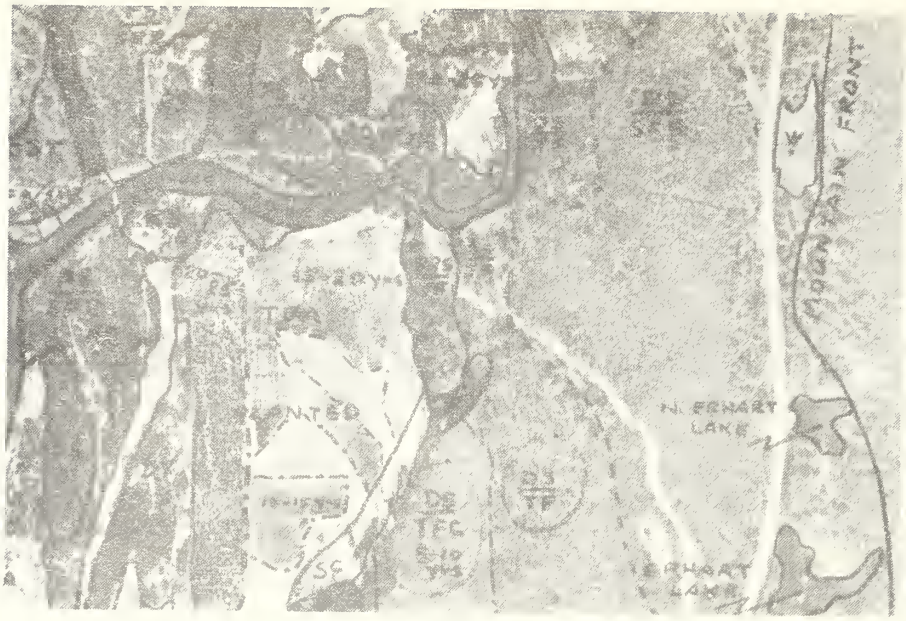
The numbers and kinds of wildlife species inhabiting second-growth transition forest is dependent on the age of the forest. Younger second growth (13-25 years after logging) has a well-developed shrub layer. In older second growth (26-50 years) this shrub layer is absent or being shaded out by the dense tree canopy. The presence of this shrub layer is primarily responsible for the greater number of species, especially birds, found in younger second growth. The transition from young to older second growth is gradual and many of the same species of wildlife are found in both, the major difference being a change in abundance or degree of use. Other species are found only in one stage of second growth.

Young second growth is inhabited by 102 species--66 birds, 28 mammals, 5 amphibians, and 3 reptiles. Songbirds (57 species) are relatively abundant in this stage. Black-tailed deer, chickarees, Townsend chipmunks, brush rabbits, deer mice, purple finches, steller's jays, clouded salamanders and northern alligator lizard are some common residents of young second growth.

Older second growth is the habitat of 70 species--32 birds, 28 mammals and 10 amphibians. Relatively few songbirds (29 species) use this habitat. Black-tailed deer, deer mice and Townsend chipmunks are present but in considerably fewer numbers than in young second growth. Brush rabbits and northern alligator lizards are not usually present. The California redback vole is a common resident of older second growth. An uncommon and unique species, the red tree mouse, is found only in the older stands. All eight species of salamanders can be found in this habitat.

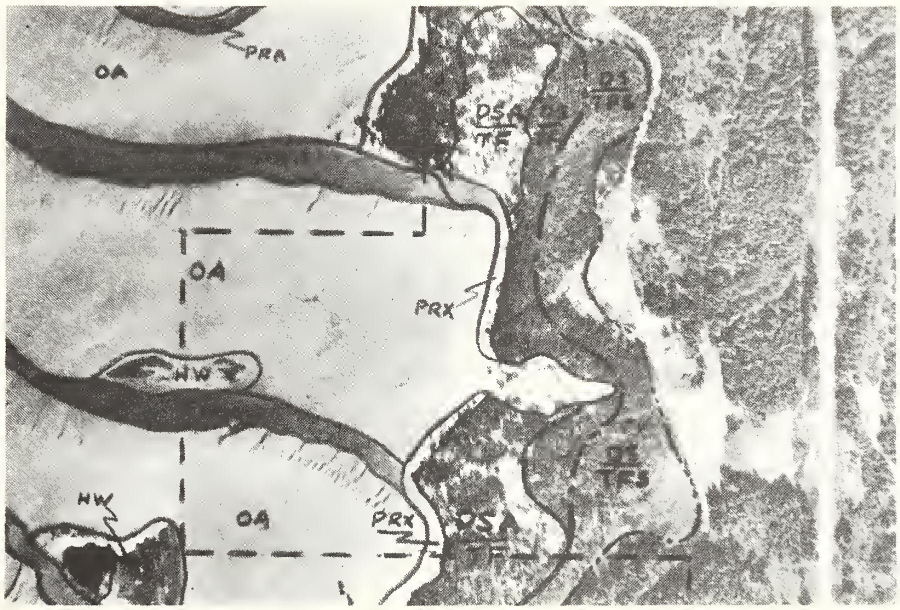
These areas offer some potential for recreational developments since they support a well-established vegetative cover and provide shelter from the winds. Since they are closely associated with the mountain front, they are often visually indistinguishable from the inland forests. From a visual standpoint, these areas do not naturally invite use. They do, however, provide a land base from which to venture onto the open sand areas. The stabilized dune surfaces provide the greatest physical opportunities for placement of man-made facilities.

The most important factor to be considered in the management of these areas is the conflict in suitability of the land to absorb man's activities while retaining the volumes of the wildlife habitat. Three important areas in this regard are transition forest, shorepine forest and remnant stands of old growth. Another factor includes the susceptibility of these sites to pine engraver, IPs sp., infestations.



Stabilized Dune Surface; Transition Forest (DS/TF) and Transition Forest, clearcut (DS/TFC), showing the proximity of these units to the Mountain Front.

Stabilized Dune Surface, Transition Forest (DS/TF). Note the open overstory and the dense shrub layer. A lake occupying a trough can be seen in the middleground. The greatest number and diversity (97 birds, 38 mammals, 7 amphibians and 3 reptiles) of wildlife species occurs in the Transition Forest. It is a very important habitat for song birds, expecially cavity nesters.



View of Stabilized Dune Surface; Transition Forest, second growth (DS/TFS).

View of Stabilized Dune Surface; shorepine forest of stabilized dunes (DS/SFR). Snags important to cavity nesting birds are abundant in this forest.

View of area subjected to blowdown and salvaged by clearcut methods on stabilized Dune Surface (DS/TFC). Large populations of deer mice, brush rabbits and Oregon voles occur in recent clearcuts.

Stabilized dune surface, transition forest $\frac{(DS)}{(TF)}$

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Slope & relief require extensive cuts (some areas) b. Creates surface runoff, ditch erosion c. Airflow velocities increase when located parallel to prevailing winds d. High water tables in some areas e. Loss of wildlife habitat; especially snags	2	4	4	a. Design to fit landscape b. Line ditches; keep below 6% grad. c. Vary alignment d. Turnpike e. Limit number of visitors; retain snags	a. -- b. -- c. Safety hazard d. Visual impact e. Reduction of recreation base
Parking Lots	a. Size limitation due to slope & relief in some areas (> 15%) b. High water table in some areas c. Loss of wildlife habitat, especially snags	2	4	4	a. Specialized design b. Turnpike or land fill c. None	a. Decrease parking stalls; increase in land base loss b. Visual impact c. --
Drain-fields	a. Slope & relief variable, often excessive (>7%) b. High water table in some areas c. Visual impact from clearing	3	1	4	a. Other collection system b. Sewage collection system c. Limited clearing	a. Increased O&M costs b. Disposal site limits c. Decreased efficiency
Camp-grounds (24-hr. occup.)	a. Areal size limitations due to slope & relief, some areas b. High water table in some areas c. Moderate visual impacts d. Loss of wildlife habitat, especially snags	2	4	3	a. Locate on more than 10% gradients b. Land fill c. Careful design d. None	a. Decrease in density of units; increase in cost b. Visual impact c. -- d. --
Human Occupancy (Day use)	a. Areal size limitations due to slope & relief, some areas b. Vegetation dense & impenetrable c. Trails required d. Moderate visual impact e. Loss of wildlife habitat, especially snags	2	4	3	a. Locate on more than 10% gradients b. Provide clearings c. Provide reinforced paths d. Careful design e. None	a. Decrease in density of units, increase in cost b. Visual impact c. Visual impact d. -- e. --
Human Occupancy (Ped. access)	a. Vegetation is natural barrier b. Wildlife harassment	2	2	2	a. Provide reinforced paths b. I&E Program	a. Source of surface runoff; visual impact b. Some harassment will persist

Stabilized dune surface, transition forest $\frac{(DS)}{(TF)}$

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Vegetation is a natural barrier b. Wildlife harassment	2	3	2	a. Provide reinforced trails b. I&E Program	a. Source of runoff; slight visual impact b. Some harassment will persist
Cross-country Travel (vehicles)	a. Vegetation is a natural barrier b. Conflict in recreational experience c. Wildlife harassment	5	3	4	a. Provide reinforced & drained running surface (see Road Construction) b. None c. I&E Program	a. Source of runoff; visual impact b. -- c. Some harassment will persist
Buildings (Contin. found)	a. Slope & relief variable & steep (>15%) some areas b. High water table in some areas c. Visual impact	1		3	a. Custom planning b. Land fill c. Custom design	a. ? b. Visual impact c. --
Buildings (Pole found.)	a. Visual impact	1		2	a. Custom design	a. --
Powerline Tower Install.	a. Quantity of clearing required b. Occasional area of high water table c. Loss of wildlife habitat, especially snags; harassment	3	4	5	a. Design to fit landscape b. Buried pipe c. Locate perpendicular to stand; restrict use of service road; I&E	a. Loss of aesthetic values b. Visual impact c. Some habitat loss & harassment will occur
Buried Pipeline Install.	a. Quantity of clearing required b. Occasional area of high water table c. Loss of wildlife habitat, especially snags, & harassment	3	4	3	a. Design to fit landscape b. Corros-resist. pipe; pumping req. c. Locate perpendicular to stand; restrict use of service road; I&E	a. Loss of aesthetic values b. Safety hazard during construction c. Some habitat loss & harassment will occur.
Vegeta. Stabiliz. (Dunegrass)	a. Undesirable plant composition b. Shading & plant composition	4	3	4	a. Plant with natives or adapt. species b. --	a. -- b. --

Stabilized dune surface, transition forest, old growth $\frac{(DS)}{(TFO)}$

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Slope & relief require extensive cuts (some areas) b. Creates surface runoff, ditch erosion c. Airflow velocities increase when located parallel to prevailing winds d. High water table in some areas e. Loss of critical wildlife habitat	2	5	4	a. Design to fit landscape b. line ditches; keep below 6% gradients c. Vary alignment d. Turnpike e. None	a. -- b. -- c. Safety hazard during construction d. Visual impact e. --
Parking Lots	a. Size limitations due to slopes & relief (>15%) in some areas (visual) b. High water table in some areas c. Loss of critical wildlife habitat	2	5	4	a. Specialized design b. Turnpike or land fill c. None	a. Decrease parking stalls; increase in land base loss b. Visual impact c. None
Drainfields	a. Slope & relief variable, often excessive (>7%) b. High water table in some areas c. Loss of critical wildlife habitat	3	5	5	a. Other collection system b. Sewage collection system c. Sewage collection system	a. Increased O&M costs b. Disposal site limitation c. Disposal site limitation
Campgrounds (24-hr. occup.)	a. Areal size limitations due to slope & relief, some areas b. High water table in some areas c. Moderate modification to charac. landscape d. Loss of critical wildlife habitat	2	5	3	a. Locate on more than 10% gradients b. Land fill c. Careful design d. None	a. Decrease in density of units; increase in costs b. Visual impact c. -- d. --
Human Occupancy (Day use)	a. Areal size limitations due to slope & relief, some areas b. High water table in some areas c. Moderate modification to charac. landscape d. Loss of critical wildlife habitat	2	5	3	a. Locate on more than 10% gradients b. Land fill c. Careful design d. None	a. Decrease in density of units; increase in costs b. Visual impact c. -- d. --
Human Occupancy (Ped. access)	a. Vegetation is a natural barrier b. Wildlife harassment	2	2	1	a. Provide reinforced paths b. I&E Program	a. Visual impact (slight) b.--

Stabilized Dune Surface, transition forest, old growth (DS)/(TFO)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Vegetation is a natural barrier b. Wildlife harassment	2	2	1	a. Provide reinforced trails b. I&E; restrict to trails	a. Source of runoff; slight visual impact b. Some harassment will persist
Cross-country Travel (vehicles)	a. Vegetation is a natural barrier b. Conflict in recreational experience c. Wildlife harassment	5	4	3	a. Provide reinforced & drained running surface (see Road Construction) b. None c. I&E; restrict to trails	a. Source of runoff; visual impact b. -- c. Some harassment will persist
Buildings (Contin. found.)	a. Slope & relief variable & steep (>15%) some areas b. High water table in some areas c. Visual impact d. Loss of critical habitat	1	5	2	a. Custom planning b. Land fill c. Custom design d. None	a. ? b. Visual impact c. -- d. --
Buildings (Pole found.)	a. Visual impact b. Loss of critical habitat	1	5	2	a. Custom design b. None	a. -- b. --
Powerline Tower Install.	a. Quantity of clearing required (visual impact) b. Occasional area of high water table c. Loss of critical habitat	3	5	3	a. Design to fit landscape b. Buried pipe c. None	a. Loss of aesthetic value b. -- c. --
Buried Pipeline Install.	a. Quantity of clearing required (visual impact) b. Occasional area of high water table c. Loss of critical habitat	3	5	3	a. Design to fit landscape b. Corros.-resist. pipe; pumping required c. None	a. Loss of aesthetic value b. Safety hazards during construction c. --
Vegetat. Stabiliz. (Dunegrass)	a. Undesirable plant composition b. Shading - plant competition	4	5	4	a. Plant with natives or adapt. species b. --	a. -- b. --

Stabilized Dune Surface, Transition Forest, Clearcut 2-12 years (DS/TFC)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Slope & relief requires extensive cuts (some areas) (visual) b. Creates surface run-off, ditch erosion c. Airflow velocities increase when located parallel to prevailing winds d. High water table in some areas e. Loss of wildlife habitat and harassment	2	3	4	a. Design to fit landscape b. Line ditches, keep below 6% gradients c. Vary alignment d. Turnpike e. Limit no. of visitors; I & E Prog.	a. -- b. -- c. Safety hazard e. Visual impact f. Reduction of recreation base; some harassment will persist
Parking Lots	a. Size limitations due to slope & relief (in excess of 15% in some areas) (visual) b. High water table in some areas c. Loss of wildlife habitat and harassment	2	3	4	a. Specialized design b. Turnpike or landfill c. Limit number of visitors, I&E Pro.	a. Decrease parking stalls, incr. in land base loss b. Visual impact c. Reduction of recreation base; some harassment will persist
Drainfields	a. Slope & relief variable, often excessive of 7% b. High water table in some areas c. Modification of char. landscape	3	1	3	a. Other collection system b. Sew. collection system c. Limit size and clearing	a. Increased O & M costs b. Disposal site limit c. Limited capacity
Campgrounds (24-hr. Occup.)	a. Areal size limitations due to slope & relief (some areas) b. High water table in some areas c. Moderate modification to char. landscape d. Loss of wildlife habitat and harassment	2	3	3	a. Locate on more than 10% gradients b. Landfill c. Careful design d. Limit no. of visitors; I & E Pro.	a. Decrease in density of units, incr. in costs b. Visual impact d. Reduction of recreation base; some harassment will persist
Human Occup. (Day Use)	a. Areal size limitations due to slope & relief, some areas b. High water table in some areas c. Moderate modification to char. landscape d. Loss of wildlife habitat and harassment	2	3	3	a. Locate on more than 10% gradient b. Landfills c. Careful design d. Limit no. of visitors; I & E Pro.	a. Decrease in density of units, incr. in costs b. Visual impact c. -- d. Reduction of recreation base; some harassment will persist
Human Occup. (Ped. Access)	a. Vegetation is a natural barrier b. Wildlife harassment	2	2	2	a. Provide reinforced paths b. I & E Program	a. Visual impact (slight) b. Some harassment will persist

Stabilized Dune Surface, Transition Forest, Clearcut 2-12 years (DS/TFC)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Vegetation is a natural barrier	2		2	a. Provide reinforced trails	a. Source of run-off, slight visual impact
	b. Wildlife harassment		2		b. I & E Program	b. Some harassment will persist
Cross-Country Travel (Vehicles)	a. Vegetation is a natural barrier	5			a. Provide reinforced & drained running surface (see road const.)	a. Source of run-off; visual impact
	b. Conflict in recreation exper.				b. None	b. --
	c. Visual impact from trailing			3	c. Admin. control	c. --
	d. Wildlife harassment		2		d. I & E Program	d. Some harassment will persist
Buildings (Contin. Found.)	a. Slope & relief variable and steep (in excess of 15% in some areas)	1			a. Custom planning	a. ?
	b. High water table in some areas				b. Landfill	b. Visual impact
	c. Visual impact			2	c. Custom design	c. --
Buildings (Pole Found.)	a. Visual impact	1		2	a. Custom design	a. --
Powerline Tower Install.	a. Quantity of clearing required - visual impact	3		3	a. Design to fit landscape	a. Loss of aesthetic value
	b. Occ. area of high water table				b. Buried pipe	b. --
	c. Loss of wildlife habitat, harassment		3		c. None	c. --
Buried Pipeline Install.	a. Quantity of clearing required; visual impact	3		3	a. Design to fit landscape	a. Loss of aesthetic value
	b. Occ. area of high water table				b. Corros. resist pipe, pumping required	b. Safety hazard
	c. Loss of wildlife habitat, harassment				c. None	c. --
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant composition	4		4	a. Plant w/natives or adapt. species	a. --
	b. Shading and plant compet.					

Stabilized Dune Surface, Transition Forest, Second Growth, 12-50 years (DS/TFS)

Facility of Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Slope & relief requires extensive cuts (some areas) (visual) b. Creates surface run-off, ditch erosion c. Airflow velocities increase when located parallel to prevailing winds d. High water table in some areas e. Loss of wildlife habitat	2	4	4	a. Design to fit landscape b. Line ditches, keep below 6% gradie. c. Vary alignment d. Turnpike e. Limit number of visitors	a. -- b. -- c. Safety hazard d. Visual impact e. Reduction of recreation base
Parking Lots	a. Size limitation due to slope & relief (in excess of 15% in some areas) b. High water table in some areas c. Visual conflict d. Loss of wildlife habitat	2	4	4	a. Specialized design b. Turnpike or landfill c. d. Limit no. of visitors, confine to a few areas	a. Decrease parking stalls, incr. in land base loss b. Visual impact c. -- d. --
Drainfields	a. Slope & relief variable, often in excess of 7% b. High water table in some areas c. Visual incompatibility	3	1	5	a. Other collection system b. Sew. collection system c. Limit clearing	a. Increased O & M costs b. Disposal site limit. c. Limit efficiency
Campgrounds (24-hr. Occup.)	a. Areal size limitations due to slope relief, some areas b. High water table in some areas c. Potential alteration of char. landscape d. Loss of wildlife habitat	2	4	3	a. Locate on more than 10% gradient b. Landfill c. Careful design & const. d. Limit number of visitors, confine to a few areas	a. Decrease in density of units, incr. in costs b. Visual impact d. Reduction of recreation base
Human Occup. (Day Use)	a. Areal size limitations due to slope & relief (some areas) b. High water table in some areas c. Potential alteration of char. landscape d. Loss of wildlife habitat	2	4	3	a. Locate on more than 10% gradient b. Landfill c. Careful design const. d. Limit number of visitors, confine to a few areas	a. Decrease in density of units, increase in costs b. Visual impact c. -- d. Reduction of recreation base
Human Occup. (Ped. Access)	a. Vegetation is a natural barrier b. Wildlife harassment	2	2	2	a. Provide reinforced paths b. I & E Program	a. Potential visual impact (slight) b. Some harassment will persist

Stabilized Dune Surface, Transition Forest, Second Growth, 12-50 years (DS/TFS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country (Horses)	a. Vegetation is a natural barrier b. Wildlife harassment	2	2	2	a. Provide reinforced trails b. I & E Program	a. Source of run-off; slight vis. impact b. Some harassment will persist
Cross-Country Travel (Vehicle)	a. Vegetation is a natural barrier b. Conflict in recreation experience c. Visual impact d. Wildlife harassment	5	2	3	a. Provide reinforced and drained surface (see roads const.) b. None c. None d. I & E Program	a. Source of run-off; visual impact b. -- c. -- d. Some harassment will persist
Buildings (Contin. Found.)	a. Slope & relief variable & steep (in excess of 15% in some areas) b. High water table in some areas c. Visual impact	1		3	a. Custom planning b. Landfill c. Custom design	a. ? b. Visual impact c. --
Buildings (Pole Found.)	a. Visual impact	1		2	a. Custom design placement	a. --
Powerline Tower Install.	a. Quantity of clearing required b. Occ. area of high water table c. Loss of wildlife habitat and harassment	3	3	4	a. Design to fit landscape b. Buried pipe c. Locate perpen. to stand, restrict use of service road; I & E	a. Loss of aesthetic value b. Visual impact c. Some habitat loss & harassment will occur
Buried Pipeline Install.	a. Quantity of clearing required b. Occ. area of high water table c. Loss of wildlife habitat and harassment	3	3	4	a. Design to fit landscape b. Corros. resist pipe, pumping requir. c. Locate perpend. to stand, restrict use of service road; I & E Pro.	a. Loss of aesthetic value b. Safety hazard during construction c. Some habitat loss & harassment will occur
Vegetative Stabiliza. (Dunegrass)	a. Undesirable plant composition b. Shading and plant competition	4	3	4	a. Plant w/natives or adapt species	a. --

Stabilized dune surface, shorepine forest of Stabilized Dunes $\frac{(DS)}{(SFR)}$

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Slope & relief require extensive cuts (some areas) b. Creates surface runoff, ditch erosion c. Airflow velocities increase when located parallel to prevailing winds d. High water table in some areas e. Destruction of snags-critical habitat -(cavity nesters, birds of prey)	2	4	4	a. Design to fit landscape b. Line ditches; keep below 6% gradient c. Vary alignment d. Turnpike e. Identify & protect specific areas	a. Neg. visual impact will persist in some areas b. -- c. Safety hazard d. Visual impact e. Reduction of recreation base
Parking Lots	a. Size limitations due to slope & relief (>15%) in some areas b. High water table in some areas c. Visual incompatibility d. Snags - critical habit -(cavity nesters & birds of prey) harassment	2	4	4	a. Specialized design b. Turnpike or land fill c. Specialized design d. Identify & protect specific areas; I&E Program	a. Decrease parking stalls; increase in land base loss b. Visual impact c. Decrease parking stalls; inc. in land base loss d. Reduction of recreation base; some harassment will persist
Drainfields	a. Slope & relief variable, often excessive (>70%) b. High water table in some areas c. Destruction of snags--critical habitat (cavity nesters & birds of prey)	3	3	5	a. Other collection system b. Sewage collection system c. Identify & protect specific areas	a. Increased O&M costs b. Disposal site limit. c. Reduction of recreation base
Campgrounds (24-hr. occupancy)	a. Areal size limitations due to slope & relief, some areas b. High water table in some areas c. Slight visual impact d. Destruct. of snags--critical Habitat (cavity nesters & birds of prey), harassment	2	4	4	a. Locate on more than 10% gradients b. Land fill c. Careful design d. Identify & protect specific areas; I&E	a. Decrease in density of units; increase in costs; visual impacts b. Visual impact c. Decrease in density d. Reduction of recreation base; some harassment will persist
Human Occupancy (Day use)	a. Areal size limitations due to slope & relief, some areas b. High water table in some areas c. Slight visual impact d. Destruction of snags--critical habitat (cavity nesters, birds of prey), harassment	2	4	2	a. Locate on more than 10% gradients b. Land fill c. Careful design d. Identify & protect specific areas; I&E	a. Decrease in density of units; increase in costs b. Visual impact c. Decrease in density of units; increase in costs d. Reduction of recreation base; some harassment will persist
Human Occupancy (Ped. access)	a. Vegetation is a natural barrier b. Wildlife harassment	2	2	2	a. Provide reinforced paths b. I&E Program	a. Visual impact b. Some harassment will persist

Stabilized Dune, Eroding, Shorepine Forest of Stabilized Dunes (DSA/SFR)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Cross-Country Travel (Horses)	a. Vegetation is a natural barrier b. Wildlife harassment	3	2	2	a. Provide reinforced trails b. I & E Program	a. Source of surface run-off; slight visual impact b. Some harassment will persist
Cross-Country Travel (Vehicles)	a. Vegetation is a natural barrier b. Wildlife harassment	5	2	3	a. Provide reinforced & drained running surface (see roads constuc.) b. I & E Program	a. Source of surface run-off; visual imp. b. Some harassment will persist
Buildings (Contin. Found.)	a. Slope & relief variable (in excess of 15%) b. Accelerate erosion process on fringe c. Visual impacts	3		3	a. Custom planning b. Plantings c. Custom design	a. -- b. Interference w/natural process c. --
Buildings (Pold Found.)	a. Subject to high wind velocites along fringes b. Visual design	2		2	a. None b. Custom design	a. -- b. --
Powerline Tower Install.	a. Quantity of clearing required (visual) b. Accelerate erosion process part. along fringe c. Destruc. of habitat & harassment	4	3	4	a. None b. Plantings c. Locate perpendicular to stand; I&E Program	a. -- b. Interfer. w/natural process c. Some habitat loss & haras. will occur
Buried Pipeline Install.	a. Quantity of clearing required (visual) b. Accelerate erosion process part. along fringe c. Machinery limitation in some portion d. Destruction of habitat & harassment	4	3	4	a. None b. Plantings c. Limit size & type of equipment d. Locate perpendicular to stand; I & E Program	a. -- b. Interfer. w/natural process c. -- d. Some habitat loss & haras. will occur
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant composition b. Shading & plants competition	4	3	4	a. Restore w/orig. or adapt. species b. --	a. -- b. --

Stabilized Dune Surface, Eroding (DSA): These landforms were once in a state of equilibrium but are presently being attacked, usually around the edges, by wind erosion processes. Usually they are remnants of larger features. They occur adjacent to parabolas, or small "blowouts" or isolated within the larger open sand areas. Since their semi-stabilized status has been upset, these sites are sensitive to additional disturbances by man's activities. The water table is usually below the surface. Generally the slopes are steep, 40 to 60 percent, and relief ranges from 20 to 70 feet within a short distance. These various areas comprise approximately 1.6 percent of the total area.

Transition Forest (DSA/TF): This type is found along the east fringe of the big open dunes and as islands in the open sand and is usually open and the trees are relatively small with little commercial value. Shorepine is the most numerous tree species; scattered sitka spruce grow taller than the pines; occasional Douglas-fir, hemlock, and western redcedar trees are found scattered in the stand. This open forest has a very dense shrub layer of rhododendron, evergreen huckleberry, and salal. In most areas there are some scattered wax myrtle shrubs.

Transition Forest, Second Growth (DSA/TFS): This plant community is found along U.S. Highway 101, the length of the N.R.A. The age of the stands vary from approximately 12 to 50 years since cutting, and the size of the trees range from 10-foot saplings to 75-foot-high trees. The overstory composition is usually a mixture of shorepine, sitka spruce, Douglas-fir, with scattered hemlock and western redcedar. (In young stands, the shrub layer is an important component of this community, but in older ones the shrubs are completely shaded out.) Rhododendron, evergreen huckleberry, salal, trailing blackberry, sword fern, bracken fern, etc., are the most common shrubs in second-growth forest.

Shorepine Forest of Stabilized Dunes (DSA/SFR): In this plant community, shorepine is the dominant forest species. Sitka spruce, hemlock, Douglas-fir and western redcedar also occur as scattered species within this forest type. Rhododendron, evergreen huckleberry, and salal are the main understory species. Wax myrtle, kinnikinnic and hairy manzanita can also be found.

The number and kinds of wildlife species using the forest occurring on eroding stabilized dune surfaces are dependent on the forest type. The forested islands (usually transition forest - TF) surrounded by open sand, provide very unique opportunities for studying isolated populations of small mammals.

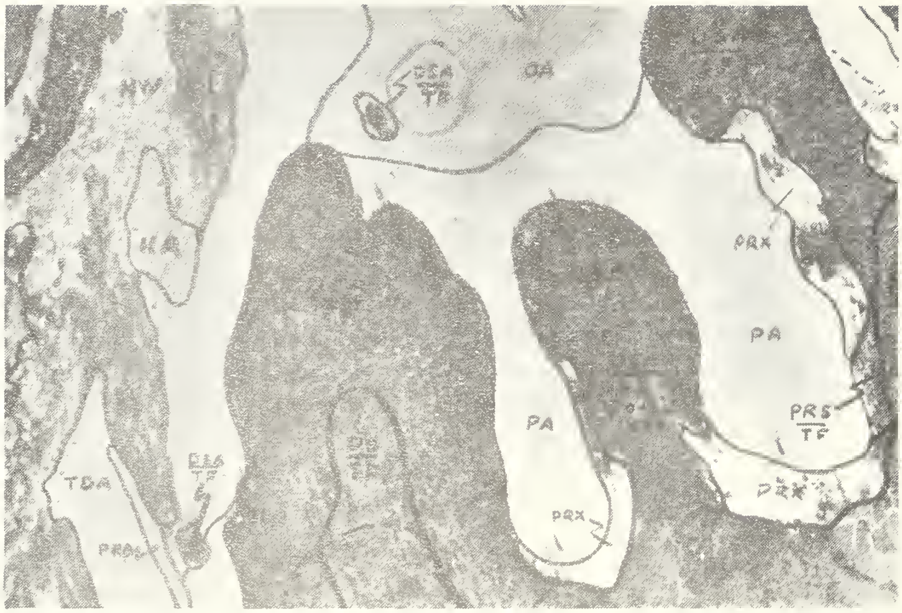
Often these landforms appear as islands of vegetation within open sand areas, and they present an extremely incongruous visual form in association with the open sands.

Their visual appearance, trees towering over the sands, sides scoured away with trees tipped and toppled, invite curiosity seekers. Several islands create the "Tom Sawyer" exploring urge, causing people to wander from island to island.

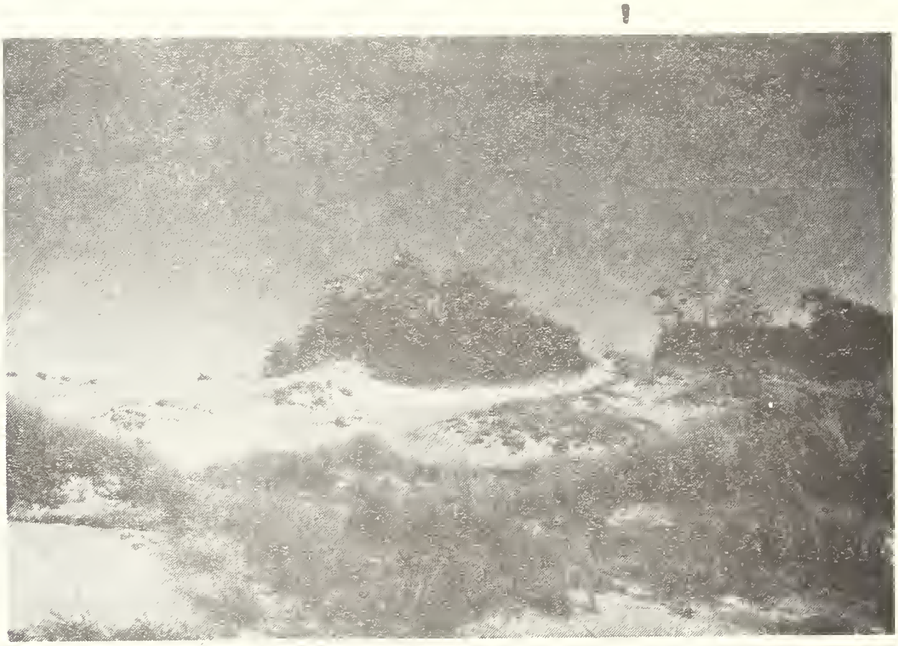
These forms often become destinations of hikers, but their lack of scale in relation to the open sands will often cause over-extended hikes.

When viewed from the landward side, these forms are silhouetted against the open sands and horizon. As such, they are individualized and become landmarks for maintaining one's bearings. However, when viewed from the seaward side, these same prominent landmarks blend and merge into the forested background. Their identities tend to disappear and travelers become confused as to where they have walked to or traveled from.

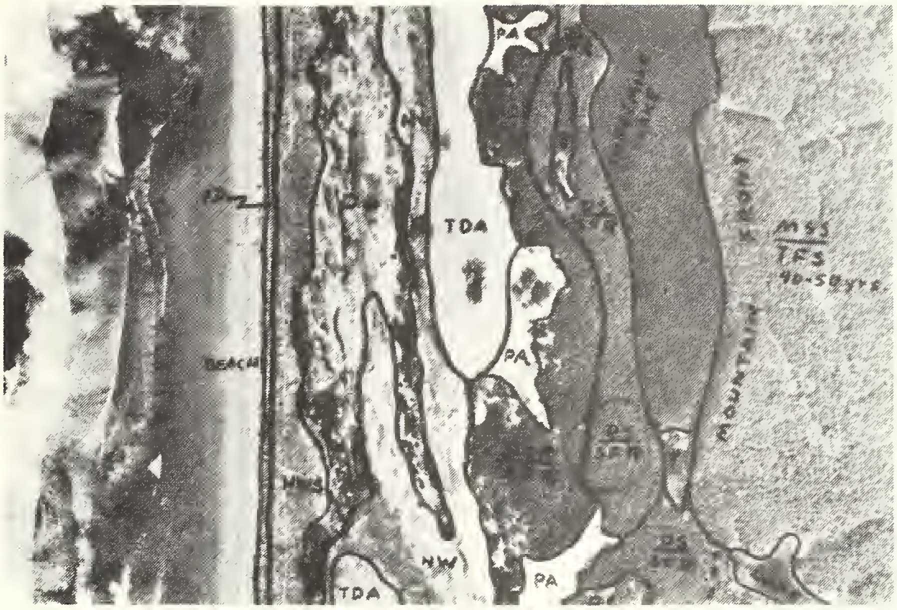
Some of the factors important to management are some islands of vegetation in the open and they provide unique opportunities for the study of isolated populations of small mammals. Since they are usually isolated remnants of larger stabilized dune surfaces, roads and trails would have to cross expanses of open sand to serve these areas. Also, these areas are susceptible to the pine engraver (Ips. species) infestations.



View of stabilized Dune surface, eroding; Transition Forest (DSA/TF) and its relationship to the Parabolas (PA) and Oblique Ridge Systems (OA). Note that some of the areas are being reduced to isolated remnants.



View of isolated DSA/TF. These islands of vegetation provide a unique opportunity for studying isolated populations of small mammals.



View of Stabilized Dune Surface, eroding; shorepine forest of Stabilized Dunes (DSA/SFR) and its relationship to the Transverse Ridge System (TDA) and the Parabolas (PA). Note the light-colored, eroding edges.

View of another but larger isolated DSA/TF. Islands of vegetation are generally used by the same species as the contiguous forest type. However, fewer species are present.

Stabilized Dune, Eroding, Transition Forest (DSA/TF) and Transition Forest, Second Growth (DSA/TFS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Destruction of some isolated & vegetated islands, scientifically unique b. Slope & relief may be excessive - visual impact c. Accelerated erosion process on fringes d. Airflow velocities increase when located parallel to prevailing winds	4	5	5 5	a. None b. Design to fit landscape c. Plantings d. Vary alignment	a. -- b. -- c. Interference w/natural process d. Safety hazard
Parking Lots	a. areal size limitations due to slope & relief, some areas in excess of 15% b. Destruction of some isolated & vegetative islands, scientif. c. Accelerated erosion process on fringes d. Visual impact	4	5	5	a. Specialized design b. None c. Plantings d. Design to fit land form	a. Decrease parking stalls, inc. land base loss b. -- c. Interference w/natural process d. Decrease in parking density
Drainfields	a. Slope variables often excessive (in excess of 7%) b. On-site investigation needed c. Accelerated erosion process on fringes d. Destruction of some isolated & vegetated islands, scient. unique e. Visual impact	3	5	4	a. Other collection system b. -- c. Plantings d. None e. Limited clearings	a. Increased O & M costs b. -- c. Interference w/natural process d. -- e. Limited efficiency
Campgrounds (24-hr. Occup.)	a. Destruction of some isolated & vegetated islands, scient. unique b. Areal size limitations due to slope & relief (some areas) c. Accelerated erosion process on fringes d. Severe wind throw hazard on fringe e. Visual impacts	5	5	4	a. None b. Locate on more than 10% gradient c. Plantings d. Hazard tree removal e. Careful designs	a. -- b. Decrease in density, increase in cost c. Interferance w/natural process d. Loss of aesthetic value e. --
Human Occup. (Day Use)	a. Areal size limitations due to slope & relief, some areas b. Destruction of some isolated & vegetative islands, scient. unique c. Accelerated erosion process on fringes d. Severe wind throw hazard on fringe e. Visual impacts	4	5	3	a. Locate on more than 10% gradient b. None c. Plantings d. hazard tree removal e. Careful designs	a. Decrease in density, inc. in cost b. -- c. Interference w/natural process d. Loss of aesthetic value e. --
Human Occup (Ped. Access)	a. Vegetation is natural barrier b. Destruct. of some isol. & veg. isls, sci. uniq. c. Uniq. oppor. for study of iso. plant & an. pop.	3	3	2	a. Provide reinforced paths b. None c. Dispersed use (no trails)	a. Source of surface run-off; visual imp. b. -- c. --

Stabilized Dune, Eroding, Transition Forest (DSA/TF) and Transition Forest, Second Growth (DSA/TFS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Vegetation is natural barrier b. Destruction of some isolated & vegetative islands, scient. unique c. Visual impacts	4	5	2 2	a. Provide reinforced trails b. None c. --	a. Source of surface run-off; vis. impact b. -- c. --
Cross-Country Travel (Vehicles)	a. Vegetation is natural barrier b. Destruction of some isolated & vegetative islands, scient. unique c. Visual impacts	5	5	3	a. Provide reinforced & drained running surface (see roads) b. None c. None	a. Source of surface run-off; vis. impact b. -- c. --
Buildings (Contin. Found.)	a. Slope & relief variable (in excess of 15%) b. Accelerated erosion process on fringes c. Destruction of some isolated & vegetated islands, scient. unique d. Visual impact	4	5	3	a. Custom planning b. Plantings c. None d. Custom design	a. ? b. Interference w/natural processes c. --
Buildings (Pole Found.)	a. Destruction of some isolated & veg. islands, scient. unique b. Visual impacts	3	5	3	a. None b. Custom design	a. --
Powerline Tower Installation	a. Quantity of clearing required (visual) b. Destruction of some isolated & veg. islands, scient. unique c. Accelerated erosion process on fringes d. Usually found as isolated remnants - must cross open sand	4	5	5	a. None b. None c. Planting d. Sacrifice visual qualities	a. -- b. -- c. Interference w/natural processes d. None
Buried Pipeline Installation	a. Quantity of clearing required (visual) b. Destruc. of some isol. & veg. islands, sci. uniq. c. Accelerated erosion process on fringes d. Usual. found as iso. remnants - must cross open sand	5	5	5	a. None b. None c. Planting d. Sacrifice visual qualities	a. -- b. -- c. Interference w/natural processes d. None
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant composition b. Destruc. of sci. uniq. of isolated veg. islands c. Shading & plant compet.	4	5	4	a. Restore w/orig. or adapt. species b. None	a. -- b. --

Stabilized Dune, Eroding, Shorepine Forest of Stabilized Dunes (DSA/SFR)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	
Road Construction	a. Slope & relief may be excessive (visual impact) b. Accelerated erosion process on fringes c. Airflow velocity increase when located parallel to prevailing winds d. Destruction of habitat and harassment	3	3	4	a. Design to fit landscape b. Plantings c. Vary alignment d. Locate perpendicular to stand; I&E Program	a. -- b. Interference w/natural process c. Safety hazard d. Some habitat loss & harassment will occur
Parking Lots	a. Areal size limitation due to slope & relief, some ares in excess of 15% b. Accelerated erosion process on fringes c. Destruc. of habitat & harassment of wildlife	3	3	4	a. Specialized design b. Plantings c. Limit number of visitors; I&E Pro.	a. Decrease parking stalls, incr. land base loss b. Interfer. w/natural process c. Some habitat loss & haras. will occur
Drain-fields	a. Slope variable, often in excess of 7% b. On-site investigation needed c. Accelerated erosion process on fringes d. Potential visual impact from clearings	3	1	4	a. Other collection system b. -- c. Plantings d. On-site investigations	a. Increased O & M cost b. -- c. Interfer. w/natural process
Campgrounds (24-hr. Occup.)	a. Areal size limit. due to slope & relief, (some area) b. Accelerated erosion process on fringe c. Severe wind throw hazard on fringe d. Visual impacts e. Destruction of habitat & haras. of wildlife	3	3	3	a. Locate on more than 10% gradient b. Plantings c. Hazard tree removal d. Careful designs e. Limit number of visitors, I&E Pro.	a. Decrease in density, increase in cost b. Interfer. w/natural process c. Loss of aesthetic value d. -- e. Some habitat loss & haras. will occur
Human Occup. (Day Use)	a. Areal size limit. due to slope & relief, (some areas) b. Accel. erosion process on fringes c. Severe wind throw hazard on fringe d. Visual impacts e. Destruc. of habitat & haras. of wildlife	3	3	3	a. Locate on more than 10% gradient b. Plantings c. Hazard tree removal d. Careful designs e. Limit number of visitors; I&E Pro.	a. Decrease in density, incr. in cost b. Interfer. w/natural process c. Loss of aesthetic value d. -- e. Some habitat loss & harassment
Human Occup. (Ped. Access)	a. Vegetation is natural barrier b. Har assment of wildlife	3	2	2	a. Provide reinforced trails b. I & E Program	a. Source of surface run-off; slight visual impact b. Some harassment will persist

Stabilized Dune, Eroding, Shorepine Forest of Stabilized Dunes (DSA/SFR)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Vegetation is a natural barrier b. Wildlife harassment	3	2	2	a. Provide reinforced trails b. I & E Program	a. Source of surface run-off; slight visual impact b. Some harassment will persist
Cross-Country Travel (Vehicles)	a. Vegetation is a natural barrier b. Wildlife harassment	5	2	3	a. Provide reinforced & drained running surface (see roads constuc.) b. I & E Program	a. Source of surface run-off; visual imp. b. Some harassment will persist
Buildings (Contin. Found.)	a. Slope & relief variable (in excess of 15%) b. Accelerate erosion process on fringe c. Visual impacts	3		3	a. Custom planning b. Plantings c. Custom design	a. -- b. Interference w/natural process c. --
Buildings (Pold Found.)	a. Subject to high wind velocites along fringes b. Visual design	2		2	a. None b. Custom design	a. -- b. --
Powerline Tower Install.	a. Quantity of clearing required (visual) b. Accelerate erosion process part. along fringe c. Destruc. of habitat & harassment	4	3	4	a. None b. Plantings c. Locate perpendicular to stand; I&E Program	a. -- b. Interfer. w/natural process c. Some habitat loss & haras. will occur
Buried Pipeline Install.	a. Quantity of clearing required (visual) b. Accelerate erosion process part. along fringe c. Machinery limitation in some portion d. Destruction of habitat & harassment	4	3	4	a. None b. Plantings c. Limit size & type of equipment d. Locate perpendicular to stand; I & E Program	a. -- b. Interfer. w/natural process c. -- d. Some habitat loss & haras. will occur
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant composition b. Shading & plants competition	4	3	4	a. Restore w/orig. or adapt. species b. --	a. -- b. --

Precipitation Ridge - slip face stabilized (PRS): This feature is usually found at the most easterly edge of the dunal landscape, perpendicular to the oblique ridge system and, in some areas, is continual in a more-or-less north-south direction for a mile or so. It is composed of a ridge, with a steeply sloping "spill-face," that results from the precipitation of sand movement along and from the adjacent oblique ridge system. The slope gradient approaches the angle of repose (about 33° or 65 percent) and relief varies from 50 to 80 feet in height. Apparently the sand supply has been shut off from these areas at some point in time and vegetation has had the opportunity to more or less stabilize these slopes. (Episode I and II). The water table is usually well below the surface. These areas combined comprise approximately .39 percent of the total area.

Transition Forest (PRS/TF): This type is found along the east fringe of the big open dunes. The stand is usually open and the trees are relatively small. Shorepine is the most numerous tree species. Old sitka spruce, occasional Douglas-fir, hemlock, and western redcedar are found scattered in the stand. This open forest has a very dense shrub layer of rhododendron, evergreen huckleberry, and salal. Scattered wax myrtle shrubs occur in some wet areas.

Shorepine Forest of Stabilized Dunes (PRS/SFR): The dominant species of this forest type is shorepine. Occasional sitka spruce, hemlock, Douglas-fir, western redcedar are found scattered but generally shorepine grows in almost pure stands. The very dense shrub layer consists of rhododendron, evergreen huckleberry and salal as the main species. Rhododendron is the dominant understory shrub growing as large as 10 to 15 feet high. Evergreen huckleberry is the second most dominant shrub, growing to 8 feet in height. Occasional wax myrtle and hairy manzanita are formed in the shrub layer. There is no herbaceous layer in this plant community.

The shorepine and transition forests have the greatest diversity of wildlife species on the N.R.A. Approximately 144 to 135 species; 97-95 birds, 38-35 mammals, 7-4 amphibians and 3 reptiles use these habitats. These habitats are very important to songbirds, especially cavity nesters. No other habitats have such a great diversity of mammal species.

Visually as well as physically, these areas offer little incentive for human use. Exceptions may be when the slip face lies between people concentration and the open sand areas. When this occurs, the slip face becomes an obstacle to be climbed. Trailing is the normal result. As the slip face is normally at or near the angle of repose for sand, trailing creates undercutting with accelerated gravitational erosion extensive enough to change the visual character.

Some important factors to be considered in the management of these areas are: (1) slopes are steep and subject to mass movement if undercut, (2) in their present state they present a barrier to sand movement from the adjacent oblique ridge system dunes and provide a degree of protection to inland areas, and (3) their importance as wildlife habitat.

View of Precipitation Ridge - Slipface stabilized; Transition Forest (PRS/TF). Note that the adjacent slipfaces are threatening (PRX) the stabilized Dune surfaces (DS/TF).

View of the PRS/TF with small portion in the right hand side beginning to threaten the lake.

View of Precipitation Ridge - Slip face; shorepine forest (PRS/SFR). Note that these units are small in areal extent.

Precipitation Ridge, slip face stabilized; Transition Forest (PRS/TF)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Steep slopes (usually in excess of 40%)	5	*		a. Plantings on excavated or expose. material	a. --
	b. Critical habitat for birds of prey				b. Identify & protect specific area	b. --
	c. Activate mass movement				c. Retaining walls	c. Neg. visual impact
	d. Visual impact			4	d. None	d. --
Parking lots	a. Steep slopes (usually in excess of 40%)	5			a. Major excavation, bin walls	a. Loss of resource; Neg. vis. impact
	b. Lack of surface area				b. Major excavation, bin walls	b. Loss of resource; Neg. vis. impact
	c. Activate mass movement				c. Retaining walls	c. Neg. visual impact
	d. Visual impact			5	d. None	d. --
Drain-fields	a. Steep slopes (usually in excess of 40%)	5			a. Sew. collection system	a. Disposal site limitation
	b. Visual impact			5	b. Sew. collection system	b. Disposal site limitation
Camp-grounds (24-hr. Occup.)	a. Steep slopes (usually in excess of 40%)	5			a. Terraces w/bin walls	a. Neg. visual impact
	b. Activate mass movement				b. Retaining walls	b. Neg. visual impact
	c. Visual impact			5	c. None	c. --
Human Occupancy (day-use)	a. Steep slopes (usually in excess of 40%)	5			a. Terraces w/bin walls	a. Neg. visual impact
	b. Activate mass movement				b. Retaining walls	b. Neg. visual impact
	c. Visual impact			5	c. None	c. --
Human Occupancy (Ped. access)	a. Veget. is natural barrier	4			a. Provide reinforced paths	a. Source of surface run-off; slight visual impact
	b. Slight visual impact			3	b. Careful location	b. --

* No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units.

Precipitation Ridge, slip face stabilized; Transition Forest (PRS/TF)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Veget. is natural barrier b. Slight visual impact	5		3	a. Provide reinforced traits b. Careful location	a. Source of surface run-off; slight visual impact b. --
Cross-Country Travel (Vehicles)	a. Veget. is natural barrier b. Visual impact	5		4	a. Provide reinforced & drained running surface (see roads) b. Careful control	a. Source of surface run-off; visual impact b. --
Buildings (Contin. Foundation)	a. Steep slopes (usually in excess of 40%) b. Visual impact	5		5	a. Major excavation of bin walls b. Custom design, careful siting	a. Neg. visual impact b. --
Buildings (pole foundation)	a. Steep slopes b. Visual impact	3		4	a. Custom design, bin walls b. Custom design, careful siting	a. Visual impact b. --
Powerline Tower Installation	a. Quantity of clearing swath required - visual b. Steep slopes - machinery limitation	4		4	a. Fit to landscape b. None	a. Activate sand movement b. --
Buried Pipeline Installation	a. Quantity of clearing swath required - visual b. Steep slopes - machinery limitation	4		4	a. Fit to landscape b. None	a. Activate sand movement b. --
Vegetative Stabiliza. (Dunegrass)	a. Undesirable plant composition b. Shading & plant competition	4		4	a. Plant w/native or adapt. species b. --	a. -- b. --

Precipitation Ridge, Slip face stabilized; Shorepine Forest of stabilized dunes (PRS/SFR)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Steep slopes (usually in excess of 40%) b. Critical habitat for birds of prey c. Activiate mass movement d. Negative visual impact	5	*	4	a. Plantings on excavated or exposed materials b. identify & protect specific area c. Retaining walls d. Careful location & design	a. -- b. -- c. Neg. visual impact d. --
Parking lots	a. Steep slopes (usually in excess of 40%) b. Lack of surface area c. Activate mass movement d. Vegetative visual impact	5		5	a. Major excavation, bin walls b. Major excavation, bin walls c. Retaining walls d. None	a. Loss of resource; neg. vis. impact b. Loss of resource; neg. vis. impact c. Neg. visual impact d. --
Drain-fields	a. Steep slopes (usually in excess of 40%) b. Modification of char. landscape	5		5	a. Sew. collection system b. None	a. Disposal site limitation b. --
Camp-grounds (24-hr. occup.)	a. Steep slopes (usually in excess of 40%) b. Activate mass movement c. Modification of char. landscape	5		5	a. Terraces w/bin walls b. Retaining walls c. None	a. Neg. visual impact b. Neg. visual impact c. --
Human Occupancy (day-use)	a. Steep slopes (usually in excess of 40%) b. Activate mass movement c. Visual impact	5		4	a. Terraces w/bin walls b. Retaining walls c. Carefull location, design & cost	a. Neg. visual impact b. Neg. visual impact c. --
Human Occupancy (Ped. access)	a. Veg. is natural barrier	4		2	a. Provide reinforced paths	a. Source of surface run-off; visual impact

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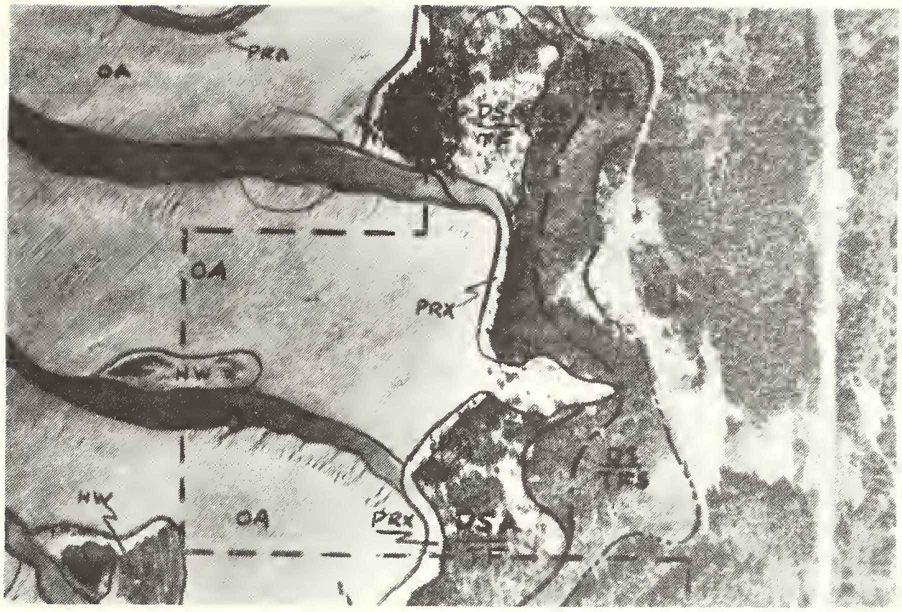
Precipitation Ridge, Slip face stabilized; Shorepine Forest of stabilized dunes (PRS/SFR)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Veget. is natural barrier	5		2	a. Provide reinforced traits	a. Source of surface run-off; visual impact
Cross-Country Travel (Vehicles)	a. Veget. is natural barrier	5		3	a. Provide reinforced drained running surface (see roads)	a. Source of surface run-off; visual impact
Buildings (Contin. foundation)	a. Steep slopes (usually in excess of 40%) b. Visual impact	5		5	a. Major excavation; bin walls b. Custom design	a. -- b. --
Buildings (Pole Foundation)	a. Steep slopes b. Visual impact	3		4	a. Custom design, bin walls b. Custom design	a. -- b. --
Powerline Tower Installation	a. Quantity of clearing swath required b. Steep slopes - Machinery limitation c. Visual impact	4		4	a. Fit to landscape b. None c. Careful location	a. Activate sand movement b. -- c. --
Buried Pipeline Installation	a. Quantity of clearing swath required b. Steep slopes - machinery limitation	4		4	a. Fit to landscape b. None	a. Activate sand movement b. --
Vegetative Stabiliza. (Dunegrass)	a. Undesirable plant composition b. Shading & plant competition	4		4	a. Plant w/native or adapt. species b. --	a. -- b. --

Active Slip Face (PRA): This feature is found in the open sand areas as part of the oblique ridge system (where large enough to delineate on the map scale used) or, in some minor areas, within the precipitation ridge portion where activity of moving sand has encroached upon the vegetation. It is composed of a ridge with a steeply sloping "spill face" or slip face that results from the precipitation of sand movement. Slope gradients approach and exceed the angle of repose (33^{o} or 65 percent), and relief may range up to over 100 feet in some places.

The water table is usually well below the surface. These areas comprise approximately 1.77 percent of the area. These areas do not support plant life. They are only used by wildlife species when traveling to adjacent areas.

These are the features, traditionally thought of, within a dunal landscape that provide the most exciting play areas. Slip faces over three feet in height become magnets to people, inviting them to climb, slide, jump, photograph or just stand back to study. Some of the factors important to management are: the visual and recreational experience afforded by these features and the need to maintain them in their unvegetated or unstabilized state.



View of the Precipitation Ridge - active slipface (PRA) and the related slipface that is threatening (PRX), the stabilized Dune surface.

View of slipface breaking loose and sliding into small area eroded to deflation base.

Active Slip Face (PRA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Actively eroding or moving landscape b. Steep slopes (usually in excess of 40%) c. Activate mass movement d. Not compatible w/char. landscape	5	*	5	a. Plantings b. Plantings on excavated or exposed material c. Retaining walls d. None	a. Reduction of open sand area b. Reduction of open sand area c. Neg. visual impact d. --
Parking lots	a. Actively moving landscape b. Steep slopes (usually in excess of 40%) c. Lack of surface area d. Not compatible w/char. landscape e. Activate mass movement	5		5	a. Plantings b. Massive excavation, bin walls c. Major excavation d. None e. Retaining walls	a. Reduction of open sand area b. Loss of resource; Neg. visual impact c. Loss of resource d. -- e. Neg. visual impact
Drainfields	a. Actively moving landscape b. Steep slopes (usually in excess of 40%)	5		1	a. Plantings b. Sew. collection system	a. Reduction of open sand area b. Disposal site limitations
Campgrounds (24-hr. Occup.)	a. Actively moving landscape b. Steep slopes (usually in excess of 40%) c. Not compatible w/char. landscape d. Accelerate mass movement	5		5	a. Planting b. Terraces on bin walls c. None d. Retaining walls	a. Reduction of open sand b. Loss of resource; neg. visual impact c. -- d. Neg. visual impact
Human Occupancy (Day-Use)	a. Actively moving landscape b. Steep slopes (usually in excess of 40%) c. Not compatible w/char. landscape d. Accelerate mass movement	5		5	a. Planting b. Terraces on bin walls c. None d. Retaining walls	a. Reduction of open sand b. Loss of resource; Neg. visual impact c. -- d. Neg. visual impact
Human Occup. (Ped. Access)		1		1		

* No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units.

Active Slip Face (PRA)

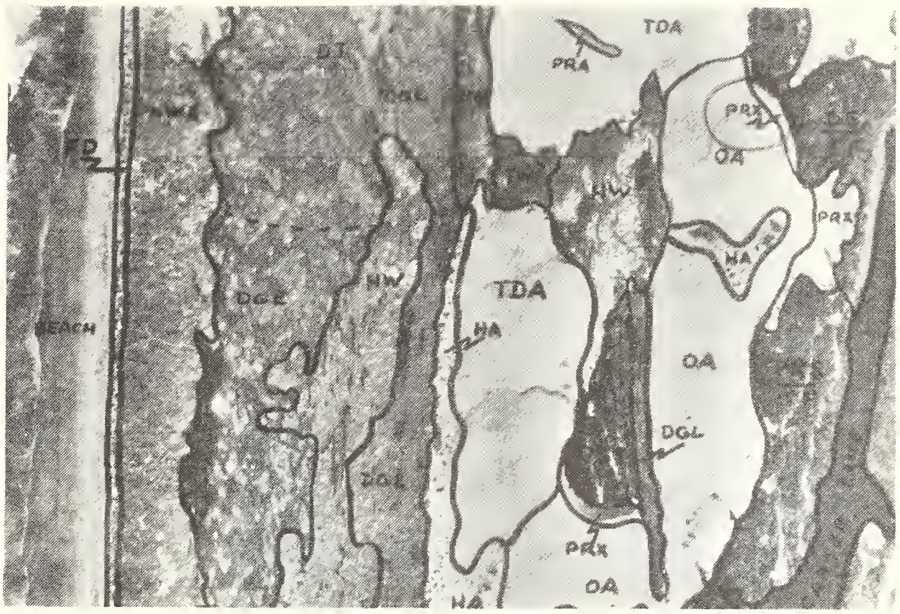
Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Safety hazard (snags & casts)	1		1	a. Signing	a. --
Cross-Country Travel (Vehicles)		1		1		
Buildings (Contin. Founda.)	a. Actively moving landscape b. Steep slopes (usually in excess of 40%) c. Not compat. w/char. landscape	5		5	a. Plantings b. Massive excavation, bin walls c. None	a. Reduction of open sand b. Loss of resource; Neg. visual impact c. --
Buildings (Pole Foundation)	a. Actively moving landscape b. Not compat. w/char. landscape c. Steep slopes	5		5	a. Plantings b. None c. Massive excavation, bin walls	a. Reduction of open sand b. -- c. Loss of resource; Neg. visual impact
Powerline Tower Installation	a. Not compatible w/char. landscape b. Actively moving landscape c. Steep slopes - machine limitations	5		5	a. None b. Plantings c. None	a. -- b. Reduction of open sand area c. --
Buried Pipeline Installation	a. Machinery limitation - steep slopes b. Actively moving landscape	5		1	a. Limit machine size b. Plantings	a. -- b. Reduction of open sand
Vegetative Stabiliz. (Dunegrass)	a. Fertility low b. Loss of scenic value	4		5	a. Fert. applied b. None	a. -- b. --

Active Slip Face, Threatening (PRX): This feature is a part of the precipitation ridge - slip face complex and has been delineated where the actively moving sand front is threatening a stabilized portion of the landscape, a lake or river, or a man-made improvement such as a road. The main purpose in identifying these areas was to provide a warning that active sand movement would create problems of retaining an adjacent in its present state. Slope gradients approach and exceed the angle of repose (33° or 65 percent) and relief may range up to 100 feet or higher in some places. The watertable is usually well below the surface. These areas comprise approximately .9 percent of the total area.

These areas do not support plant life but rather smother it. Dead and dying trees, however, provide opportunities for cavity nesting birds.

When the slip face is seen, the normal presence of semi-buried vegetation, some dead and grotesquely leaning, arouses the curiosity and encourages a closer look at this apparent destructive force.

Some important factors to management include: (1) sand movement onto an improved area can represent an important economic loss or cost; until the sand supply is shut off, advancement of the sand will persist for many years, and (2) stabilization will reduce the open-sand area land base.



View of the Precipitation Ridge - Active slip face, threatening (PRX). Note where the sand is advancing on Carter Lake and the road leading to the campground.

View of PRX that is advancing on a stabilized slip face (PRS).

View of Precipitation Ridge - Slip face, threatening (PRX). Note that this slip face is advancing into an active stream. Generally the stream has enough velocity to carry away the encroaching sands.

Active Slip Face, Threatening (PRX)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Actively eroding or moving landscape b. Steep slopes (usually in excess of 40%) c. Activate mass movement d. Not compatible w/char. landscape	5	*	5	a. Plantings b. Plantings on excavated or exposed material c. Retaining walls d. None	a. Reduction of open sand area b. Reduction of open sand area c. Neg. visual impact d. --
Parking Lots	a. Actively eroding or moving landscape b. Steep slopes c. Activate mass movement d. Not compat. w/char. landscape e. Lack of surface area	5		5	a. Plantings b. Massive excavation, bin walls c. Retaining walls d. None e. Massive excavation	a. Reduction of open sand area b. Loss of resource; Neg. visual impact c. Neg. visual impact d. -- e. Loss of resource
Drainfields	a. Actively moving landscape b. Steep slopes (usually in excess of 40%)	5		1	a. Plantings b. Sew. collection system	a. Reduction of open sand area b. Disposal site limitations
Campgrounds (24-hr. Occup.)	a. Actively moving landscape b. Steep slopes (usually in excess of 40%) c. Not compatible w/char. landscape d. Accelerate mass movement	5		5	a. Plantings b. Terraces w/bin walls c. None d. Retaining walls	a. Reduction of open sand area b. Loss of resource; Neg. visual impact c. -- d. Neg. visual impact
Human Occup. (Day Use)	a. Actively moving landscape b. Steep slopes (usually in excess of 40%) c. Not compatible w/char. landscape d. Accelerate mass movement	5		5	a. Plantings b. Terraces w/bin walls c. None d. Retaining walls	a. Reduction of open sand area b. Loss of resource; Neg. visual impact c. -- d. Neg. visual impact
Human Occup. (Ped. Access)	a. Accelerate sand movement b. Safety hazard (snags, casts)	5		1	a. Regulations & signing b. Regulations & signing	a. Admin. & enforcement b. Admin. & enforcement

* No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units.

Active Slip Face, Threatening (PRX)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Accelerate sand movement b. Safety hazard (snags, casts)	5		1	a. Regulations & signing b. Regulations & signing	a. Admin. & enforcement b. Admin. & enforcement
Cross-Country Travel (Vehicles)	a. Accelerate sand movement	5		1	a. Regulation & signing	a. Admin. & enforcment
Buildings (Contin. Founda.)	a. Not compatible w/char. landscape b. Actively moving landscape c. Steep slopes	5		5	a. None b. Plantings c. Massive excavation, bin walls	a. -- b. Reduction of open sand area c. Loss of resource, Neg. visual impact
Buildings (Pole Founda.)	a. Not compatible w/char. landscape b. Actively moving landscape c. Steep slopes	5		5	a. None b. Plantings c. Massive excavation, bin walls	a. -- b. Reduction of open sand area c. Loss of resource, Neg. visual impact
Powerline Tower Installation	a. Not compatible w/char. landscape b. Actively moving landscape c. Steep slope - machinery limitation	5		5	a. None b. Plantings c. None	a. -- b. Reduction of open sand area c. --
Buried Pipeline Installation	a. Not compatible w/char. landscape b. Actively moving landscape c. Steep slopes	5		3	a. None b. Plantings c. None	a. -- b. Reduction of open sand area c. --
Vegetative Stabiliz. (Dunegrass)	a. Fertility & moisture lacking b. Loss of scenic value	4		5	a. Fertiliz. applied b. None	a. -- b. --

Conditionally Stable Slip Face (SC): This feature is also part of the precipitation ridge - slip face complex and has been delineated where the plantings of beachgrass, etc., have shut off the sand supply or stabilized the slip face. Slope gradients approach the angle of repose (33^{o} or 65 percent) and relief may range up to 200 feet or higher in some places. These areas usually represent slip faces that had been previously threatening a lake, stream or man-made improvement. The water table is usually well below the surface. These areas comprise approximately .09 percent of the area.

This landform is basically the same as the Precipitation Ridge, slip face stabilized (PRS), except it lacks the dense vegetation cover, and in some cases it occurs as open sand where the stabilization effort was performed on the oblique-ridge system portion of the landscape. It has the capacity to invite human use, especially if open sand is evident and when it occurs in close proximity to areas of use, both visually as well as physically.

Wildlife species present in the adjacent habitat utilize this slip face to some degree.

Some of the factors important to management include the need for continued protection and maintenance.

View of Conditionally stable slip face (SC), in the lower right corner. Note that this slip face was encroaching on the river and was planted to beachgrass, etc. to successfully immobilize the sand. As long as the beachgrass plantation behind the slip face remains intact, the stability of the slip face can be relatively assured.

In contrast to the area shown above, the slip face itself has been planted as well as the portion behind it.

Conditionally Stable Slip Face (SC)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Steep slopes (usually in excess of 40%) b. Not compatible w/char. landscape c. Activate mass movement	5	*	4	a. Plantings on excavated or exposed material b. None c. Retaining walls	a. Reduction of open sand area b. -- c. Neg. visual impact
Parking lots	a. Steep slopes (usually in excess of 40%) b. Lack of surface area c. Activate mass movement d. Not compatible w/char. landscape	5		5	a. Massive excavation, bin walls b. Massive excavation c. Retaining walls d. None	a. Loss or resource; Neg. visual impact b. Loss of resource c. Navigated impact d. --
Drainfields	a. Steep slopes (usually in excess of 40%) b. Clearing required - visual modification	5		4	a. Sew. collection system b. Limited size & clearing	a. Disposal site limitation b. Limited efficiency
Campgrounds (24-hr. Occup.)	a. Steep slopes (usually in excess of 40%) b. Not compatible w/char. landscape c. Activate mass movement	5		5	a. Terraces w/bin walls b. None c. Retaining walls	a. Neg. visual impact; loss of resource b. -- c. Neg. visual impact
Human Occupancy (day-use)	a. Steep slopes (usually in excess of 40%) b. Not compatible w/char. landscape c. Activate mass movement	5		5	a. Terraces w/bin walls b. None c. Retaining walls	a. Neg. visual impact b. -- c. Neg. visual impact
Human Occupancy (Ped. access)	a. Safety hazard (casts & snags) b. Impact on adj. stabilizing veg.	5		1	a. Regulation & signing b. Regulation & signing, barriers	a. Admin. & enforcement b. Admin. & enforcement, visual impact

* No biological tolerance levels were deemed necessary for these geomorphic units. Their wildlife value can only be meaningful when studied with neighboring geomorphic units.

Conditionally Stable Slip Face (SC)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis.	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Safety hazard b. Impact on adj. stabiliz. veg.	5		1	a. Regulation & signing b. Regulation & signing, barriers	a. Admin. & enforcement b. Admin. & enforcement; visual impact
Cross-Country Travel (Vehicles)	a. Impact on adj. stabilizing veg. b. Activate mass movement	5		3	a. Regulations & signing b. Regulations & signing, barriers	a. Admin. & enforcement b. Admin. & enforcement; visual impact
Buildings (Contin. Foundation)	a. Steep slopes b. Not compatible w/char. landscape	5		5	a. Massive excav., bin walls b. None	a. Loss of resource; Neg. visual impact b. None
Buildings (Pole Foundation)	a. Steep slopes b. Not compatible w/char. landscape	5		4	a. Massive excav., bin walls b. None	a. Loss of resource; Neg. visual impact b. None
Powerline Tower Installation	a. Machinery limitation - steep slopes b. Not compatible w/char. landscape	5		5	a. None b. None	a. -- b. --
Buried Pipeline Installation	a. Machinery limitations - steep slopes b. Accelerate erosion process	5		3	a. None b. Re-plant	a. -- b. --
Vegetative Stabiliza. (Dunegrass)	a. Fertility low b. Loss of scenic value	3		4	a. Fert. applied b. None	a. -- b. --

Rolling, Partially Stabilized Dune Surface (RS): This feature often occurs at the lower levels of the dunal landscape, adjacent to the deflation plain or stabilized flood plain deposits. It is of low overall relief but quite rolling (5-30 feet high above the deflation base), and slope gradients range from 2 to 30 percent. Depressions that fill with water in the winter months are not uncommon. This landscape appears to be in the pioneer or transition stage of vegetative stabilization, and is quite sensitive to man's activities. The depth to the water table is quite variable but it is usually within 5 feet of the surface. These areas comprise approximately .68 percent of the total area.

Shorepine - Kinnikinnic: This plant community is an early sand stabilization stage found at the edge of shorepine forest where there is little or no sand deposition. It ranges from just above the deflation plain to dune surfaces high above the water table. It is characterized by scattered shorepine and by a low-growing, mat-like shrub - kinnikinnic.

The plant succession stages that lead to the shorepine-kinnikinnic associations get started on bare sand. Red fescue and sticky goldenrod are the first species to move in on open sand. Later they are followed by a moss which forms almost a continuous mat on the sand surface. These three modify the surface's micro-environmental conditions which then allow kinnikinnic to grow. Once kinnikinnic gets established, it shades out the moss replacing it entirely. At this time shorepine seedlings and the shrub hairy manzanita appear; the manzanita will grow to heights of 3 and 4 feet before the pine finally overtakes it. Eventually a shorepine forest will follow with a shrub layer characteristic of the particular site.

Occasionally the shorepine-kinnikinnic association is not a young stage of plant succession, but instead, a very open overstory of old and dead shorepine trees with a dense mat of kinnikinnic covering the ground. Shorepine seedlings, young salal, and evergreen huckleberry are present in small numbers indicating that plant succession toward a shorepine forest is in progress. Whether this is a delayed stage in plant succession or a setback following blowdown or fire, is not known.

The shorepine-kinnikinnic plant community is used by various combinations and numbers of the 135 wildlife species which occur in the shorepine forests. The number and kind of species present are dependent on the age and structure of the shorepine-kinnikinnic community. Certain portions of this community contain many dead trees. These areas are very important to cavity nesting birds and some mammals.

In terms of inviting use, it is the most appealing visual form present in the dunal landscape. The character of the landscape seems to say "stroll through here, linger awhile, camp here." To the visitor, this landscape seems to provide the most suitable looking wildlife habitat. It looks like an area to see wildlife in; therefore, it encourages human use.

Factors important to management include: (1) the sensitivity of the vegetation to withstand man's activities, (2) the visual resource value and recreational experience, and (3) the wildlife habitat it affords.

View of Rolling, Partially Stabilized Dune Surface (RS). Note the very open shore pine overstory. These areas are unique in their "east-side" type appearance with kinnikinnic and manzanita ground cover. (Note DTO above is in error; it should read DT)

View of Pioneering Plant Community; note the amount of bare ground exposed.

Rolling, partially stabilized dune surface (RS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Some areas of high water table b. Rolling, with considerable relief c. Some snag areas - critical habitat for cavity nesters d. Visual impacts	2	4	3	a. Turnpike b. Design to fit landscape c. Identify and protect specific areas d. Design to fit landscape	a. Visual impacts b. -- c. Reduction of recreation base d. --
Parking Lots	a. Some areas of high water table b. Rolling, variable relief c. Some snag areas - critical habitat for cavity nesters d. Visual impact	2	4	4	a. Land fill b. Major excavations c. Identify and protect specific areas d. Design to fit landscape	a. Visual impact b. Resource loss, visual impact c. Reduction of recreation base d. Limited parking volume
Drainfields	a. Onsite invest. needed (high water table, slopes) b. Some snag areas - critical habitat for cavity nesters c. Visual impact from clearing	3	4	4	a. -- b. Identify & protect specific areas c. Limited clearing	a. -- b. Reduction of recreation base c. Limit efficiency
Campgrounds (24-hr. occup.)	a. Veg. sensitive to trampling b. Gall rust susceptibility c. Some areas of high water table d. Surface area lacking e. Some snag areas-critical habitat for cavity nest.	4	4 4	2	a. Reinforce pathways; barriers b. See I&DC for treatments c. Land fill d. Specialized design e. Identify & protect specific areas	a. Admin. & enforcement; visual impact b. -- c. Visual impact d. Decrease in density; increase in cost e. Reduction of recreation base
Human Occupancy (Day use)	a. Veg. sensitive to trampling b. Gall rust susceptibility c. Some areas of high water table d. Some snag areas-critical habitat for cavity nest.	3	4 4	2	a. Reinforce pathways, barriers b. See I&DC for treatments c. Land fill d. Identify & protect specific areas	a. Admin. & enforcement; visual impact b. -- c. Visual impacts d. Reduction of recreation base
Human Occupancy (Ped. access)	a. Veg. sensitive to trampling b. Wildlife harassment	2	2 2	1	a. Reinforce pathways, barriers b. I&E Program	a. Admin. & enforcement; slight vis.impact b. --

Rolling, partially stabilized dune surface (RS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Veg. sensitive to trampling b. Wildlife harassment	3	5 3	2	a. Reinforce pathways, barriers b. I&E Program	a. Admin. & enforcement; slight vis. impact b. --
Cross-country Travel (vehicles)	a. Veg. sensitive to wheel traffic b. Wildlife harassment	4	5 4	4	a. Provide reinforced & drained running surface (See Road Construction) b. I&E Program	a. Source of runoff (some areas; visual impact) b. --
Buildings (Contin. found.)	a. Some areas of high water table b. Some snag areas - critical habitat for cavity nesters c. Visual impact	2	2	3	a. Land fill b. Identify & protect specific areas c. Custom design	a. Destruction of snag areas; critical habitat; visual impact b. Reduction of recreation base c. --
Buildings (Pole found.)	a. Some snag areas - critical habitat for cavity nesters b. Visual Impact	1	2	3	a. Identify & protect specific areas b. Custom design	a. Reduction of recreation base b. --
Powerline Tower Install.	a. Clearing swath required b. Marginally compatible with charac. landscape c. Some snag areas--critical habitat for cavity nesters	4	4	4	a. Design to fit landscape b. None c. Identify & protect specific areas	a. Destruction of snag areas--crit. habitat b. -- c. --
Buried Pipeline Install.	a. Clearing swath required b. Loss of sensitive & pioneering plant cover c. Some snag areas--critical habitat for cavity nesters	3	4	4	a. Design to fit landscape b. None c. Identify & protect critical areas	a. -- b. -- c. --
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant community	3	3	4	a. Restore with natives or adapt. species	a. --

Flood Plain, Active (FA): This landform occurs within the dunal area but is associated with the river outlets and estuaries. It represents deposits left by the changing stream course, or reduction in streamflow velocity and tides. It is subject to tidal or seasonal flooding, additional deposition or even destruction. The water table is usually within 2 feet of the surface even during the drier parts of the year. Slope gradients range from 0 to 3 percent, and vertical relief varies from 1 to 3 feet above the stream level. These areas comprise approximately .66 percent of the area.

These features are usually transient in nature but may persist long enough for vegetation such as willow, sedges or grasses to become established.

Salt Marsh Meadow Plant Communities (FA/SM): The vegetation found growing on these sites depends on the salinity of the estuary water, frequency of water intrusion, substrate, etc. Two general vegetation types on the active flood plain can be recognized in the N.R.A., a dry meadow-like plant community and a wet salt marsh. No attempt was made to identify plant species in the plant communities. The meadow-like community is composed of grasses, forbs, and rushes. It occurs above the water table and is only subjected to tidal incursion during severe winter storms and extremely high tides. The meadow near the mouth of Siltcoos River, named Driftwood Campground, is an example of this plant community. The true salt marsh is found on mud flats frequently flooded by the tide. This type of salt marsh is found within the N.R.A. on portions of the north shore of the Umpqua River and along the Siltcoos River.

The active flood plains, salt marshes and salt meadows are integral parts of the estuary. These habitats are extremely critical for many species of wildlife.

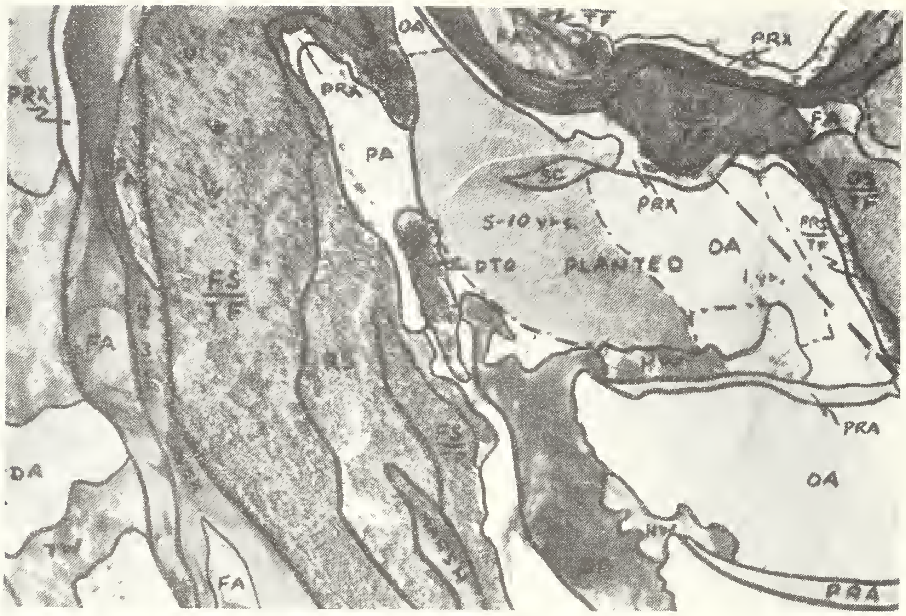
Estuaries are the most fertile natural-occurring areas in the world. The salt marsh and meadow plant communities contribute nutrients and organic matter to the estuaries from decaying vegetation. Plankton and invertebrate organisms, the major food sources in the estuary, are dependent on these nutrients and organic matter. Many of the invertebrates reside in the unvegetated flood plain. At high tide, ocean and bay fish move onto the flood plains from the ocean and estuary. These fish feed on the invertebrates and other food sources washed down by the rivers. The fish, in turn, attract fish-eating birds such as the bald eagle, osprey, great blue heron, gulls and terns. During low tides, when these flood plains are exposed, shore birds, especially sanderlings, dunlins, western sandpipers, whimbrels and snowy plover feed on the invertebrate organisms. The active flood plains of the Umpqua River are inhabited by soft-shelled clams.

Estuaries are used by 96 species of wildlife, 88 birds and 8 mammals. In addition, 70 species of fish may use an estuary, depending upon its size, salinity or season of the year. Salt marshes and meadows are inhabited by 77 species of wildlife--66 birds, 8 mammals, 2 amphibians, and 1 reptile. Many of the species that use the estuaries also use the unvegetated flood plain and salt marshes. Most species that inhabit the salt marshes or meadows are the same species that use the estuaries and unvegetated flood plains. The pied-billed grebe, mallard duck and green-winged teal are common species in the salt marsh. Marsh hawks and Townsend meadow voles frequently use the salt meadow.

Flood plains that appear as sand bars or mud flats are seldom inviting to human occupancy except when they provide the prospect of viewing aquatic life, especially birds using the river or stream.

These meadow areas are similar to the deflation plain grasses, rushes, and sedges (DG) in appearance and only in a few areas do they invite visitor-use such as in the Siltcoos area where there is a predominance of low grasses.

Factors important to management include their critical value to wildlife and the flooding or deposition occurrences.



View of the Flood Plain active (FA). Note the proximity to the stream and the possibility for seasonal and tidal flooding. (Note DTO should be classified as DT).

Ground view of an active Flood Plain at low tide. The active Flood Plain and adjacent estuaries are critical wildlife habitats for 81 species of shore birds, waterfowl and oceanic birds. The bald eagle and osprey, rare and endangered birds, also use this habitat.

View of Flood Plain, active; salt marsh - meadow (FA/SM). Note that these areas are subject to seasonal and tidal fluctuations of the water level in the stream.

Meadow-like stage of Flood Plain; salt marsh - meadow (FA/SM). Salt marshes and meadows generate many of the nutrients which contribute to the productivity of the adjacent estuaries. They are critical wildlife habitats.

Flood plain, Active (FA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Loss of critical wildlife habitat & harassment	5	5		a. None; I&E program	a. --
	b. Flooding & water erosion hazard				b. Binwalls, gabions & riprap	b. Loss of critical wildlife habitat; visual impact
	c. Water table (poor bearing strength)			5	c. Ballast & land fill	c. Loss of critical wildlife habitat; visual impact
	d. Modification of charac. landscape				d. None	d. --
Parking Lots	a. Loss of critical wildlife habitat & harassment	5	5		a. None; I&E Program	a. --
	b. Flooding & water erosion hazard				b. Binwalls, gabion & riprap	b. Loss of critical wildlife habitat; visual impact
	c. Water table (poor bearing strength)				c. Ballast & land fill	c. Loss of critical wildlife habitat; visual impact
	d. Modification of charac. landscape			5	d. None	d. --
Drainfields	a. Estuary pollution hazard (high water table)	5	5		a. Sewage collection system	a. Limited disposal sites
	b. Critical wildlife habitat, destruction			1	b. " " "	b. " " "
	c. Subject to water erosion				c. " " "	c. " " "
Campgrounds (24-hr. occupancy)	a. Flooding & water erosion hazard	5			a. Binwalls, gabion, riprap	a. Loss of critical wildlife habitat
	b. Water table				b. Land fill	b. " " " "; visual impact
	c. Loss of critical wildlife habitat & harassment		5		c. None; I&E Program	c. --
	d. Modification of charac. landscape			5	d. None	d. --
Human Occupancy (day use)	a. Flooding & water erosion hazard	5			a. Binwalls, gabions, riprap	a. Loss of critical wildlife habitat
	b. Water table				b. Land fill	b. " " " " ; visual impact
	c. Loss of critical wildlife habitat & harassment		5		c. None; I&E Program	c. --
	d. Modification of charac. landscape			5	d. None	d. --
Human Occupancy (ped. access)	a. Subject to flooding (seasonal limitations)	1		1	a. Seasonal restriction (natural)	a. --
	b. Low carrying capacity				b. Signing & regulation	b. Admin. & enforcement
	c. Critical wildlife habitat, harassment		3		c. Restrict access; I&E	c. Reduct. of rec. land base; some harassment will persist

Flood Plain, active (FA)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Subject to flooding (seasonal limitation) b. Critical wildlife habitat, harassment	1	5	1	a. Seasonal restriction (natural) b. Restrict access; I&E Program	a. -- b. Reduct. of rec. land base; some harassment will persist
Cross-country Travel (vehicles)	a. Subject to flooding (seasonal limitation) b. Critical wildlife habitat, harassment	1	5	1	a. Seasonal restriction (natural) b. Restrict access; I&E Program	a.-- b. Reduct. of rec. land base; some harassment will persist
Buildings (Contin. found.)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat d. Modification of charac. landscape	5	5	5	a. Binwalls, gabions, riprap b. Land fill c. None d. None	a. Loss of critical wildlife habitat b. " " " "; visual impact c. -- d. --
Buildings (Pole found.)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat d. Modification of charact. landscape	5	5	5	a. Binwalls, gabions, riprap b. Land fill c. None d. None	a. Loss of critical wildlife habitat b. " " " "; visual impact c. -- d. --
Powerline Tower Install.	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat d. Not compatible with charac. landscape	5	5	5	a. Binwalls, gabions, riprap b. Land fill c. None d. None	a. Loss of critical wildlife habitat b. " " " ; visual impact c. -- d. --
Buried Pipeline Install.	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat	5	5	1	a. Binwalls, gabions, riprap b. Land fill c. None	a. Loss of critical wildlife habitat b. " " " " ; visual impact c. --
Vegeta. Stabiliz.	a. Flooding & water erosion hazard b. Loss of critical wildlife habitat	5	5	5	a. None b. None	a. -- b. --

Flood plain, active, saltmarsh-meadow $\frac{(FA)}{(sm)}$

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Loss of critical wildlife habitat & harassment b. Flooding & water erosion hazard c. Water table (poor bearing strength) d. Modification of charac. landscape	5	5	5	a. None; I&E Program b. Binwalls, gabions & riprap c. Ballast & land fill d. None	a. -- b. Loss of critical wildlife habitat; visual impact c. Loss of critical wildlife habitat, visual impact d. --
Parking Lots	a. Loss of critical wildlife habitat & harassment b. Flooding & water erosion hazard c. Water table (poor bearing strength) d. Modification of charac. landscape	5	5	5	a. None; I&E Program b. Binwalls, gabions & riprap c. Ballast & land fill d. None	a. -- b. Loss of critical wildlife habitat; visual impact c. Loss of critical wildlife habitat; visual impact d. --
Drainfields	a. Estuary pollution hazard (high water table) b. Critical wildlife habitat, destruction c. Subject to water erosion	5	5	1	a. Sewage collection system b. " " " c. " " "	a. Limited disposal sites b. " " " c. " " "
Campgrounds (24-hr occup.)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat & harassment d. Modifications of charac. landscape	5	5	5	a. Binwalls, gabions, riprap b. Land fill c. None, I&E Program d. None	a. Loss of critical wildlife habitat, visual impact b. Loss of critical wildlife habitat, visual impact c. -- d. --
Human Occup. (Day use)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat & harassment d. Modification of charac. landscape	5	5	5	a. Binwalls, gabions, riprap b. Land fill c. None; I&E Program d. None	a. Loss of critical wildlife habitat, visual impact b. Loss of critical wildlife habitat; visual impact c. -- d. --
Human Occup. (ped. access)	a. Subject to flooding (seasonal limitation) b. Low carrying capacity c. Critical wildlife habitat; harassment	2	4	1	a. Seasonal restriction (natural) b. Signing & regulation c. Limit access; I&E	a. -- b. Admin. & enforcement c. Reduct. of land base; some harassment will persist

Flood plain, active, saltmarsh-meadow (FA)/(sm)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Subject to flooding (seasonal limitation) b. Critical wildlife habitat, harassment	3	5	1	a. Seasonal restriction (natural) b. Limit access; I&E Program	a. -- b. Reduc. of rec. land base; some harassment will persist
Cross-country Travel (vehicle)	a. Subject to flooding (seasonal limitation) b. Critical wildlife habitat; harassment	4	5	2	a. Seasonal restriction (natural) b. Limit access.; I&E	a. -- b. Reduct. of rec. land base; some harassment will persist
Buildings (cont. found.)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat d. Modification of charac. landscape	5	5	4	a. Binwalls, gabions, riprap b. Land fill c. None d. Custom design	a. Loss of natural wildlife habitat; visual impact b. Loss of natural wildlife habitat; visual impact c. -- d. --
Buildings (pole found.)	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat d. Modification of charac. landscape	5	5	4	a. Binwalls, gabions, riprap b. Land fill c. None d. Custom design	a. Loss of natural wildlife habitat; visual impact b. Loss of natural wildlife habitat; visual impact c. -- d. --
Powerline Tower Install.	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat d. Not compatible with charac. landscape	4	5	5	a. Binwalls, gabions, riprap b. Land fill c. None d. None	a. Loss of natural wildlife habitat; visual impact b. Loss of natural wildlife habitat; visual impact c. -- d. --
Buried Pipeline Install.	a. Flooding & water erosion hazard b. Water table c. Loss of critical wildlife habitat	5	5	2	a. Binwalls, gabions, riprap b. Land fill c. None	a. Loss of natural wildlife habitat; visual impact b. Loss of natural wildlife habitat; visual impact c. --
Vegeta. Stabiliz. (dunegrass)	a. Flooding & water erosion hazard Loss of critical wildlife habitat	4	5	5	a. None b. None	a. -- b. --

Flood Plain, Stabilized (FS): These features represent older flood plain deposits that have been stabilized by naturally-occurring vegetation. The water table varies from at or near the surface to 5 feet below the surface in the drier parts of the year. Slope gradients range from 0-3 percent with vertical relief of up to 10 feet above low stream level. These areas comprise approximately .41 percent of the area.

The stabilized flood plain is vegetated by two forest communities, the shorepine forest of the stabilized dunes and the transition forest of the western foothills of the Coast Range. Because of the low water table, species characteristic to both the shorepine forest of the deflation plain and of the stabilized dunes, are found growing at these sites. The predominance of rhododendron over wax myrtle in the stabilized flood plain is an indication that the dominant plant community in the stabilized dunes is the shorepine forest.

Shorepine Forest of Stabilized Dunes (FS/SFR): In this plant community, shorepine is the dominant forest species. Sitka spruce, hemlock, Douglas-fir, western redcedar also occur as scattered species within the forest type. Rhododendron, evergreen huckleberry and salal are the main understory species. Wax myrtle, kinnikinnic, and hairy manzanita also occur.

Transition Forest (FS/TF): The transition forest is a mixture of five tree species: sitka spruce, shorepine, western hemlock, western redcedar and Douglas-fir. Minor tree species are alder and willow. Important shrub species of this community are rhododendron, salal, evergreen huckleberry, trailing blackberry, salmonberry and thimbleberry.

The forested portion of the stabilized flood plain adjacent to rivers and streams, is a critical wildlife habitat. Many species of mammals, birds and amphibians concentrate their activities near water. Mammals use the forested strips along riverbanks as travel routes.

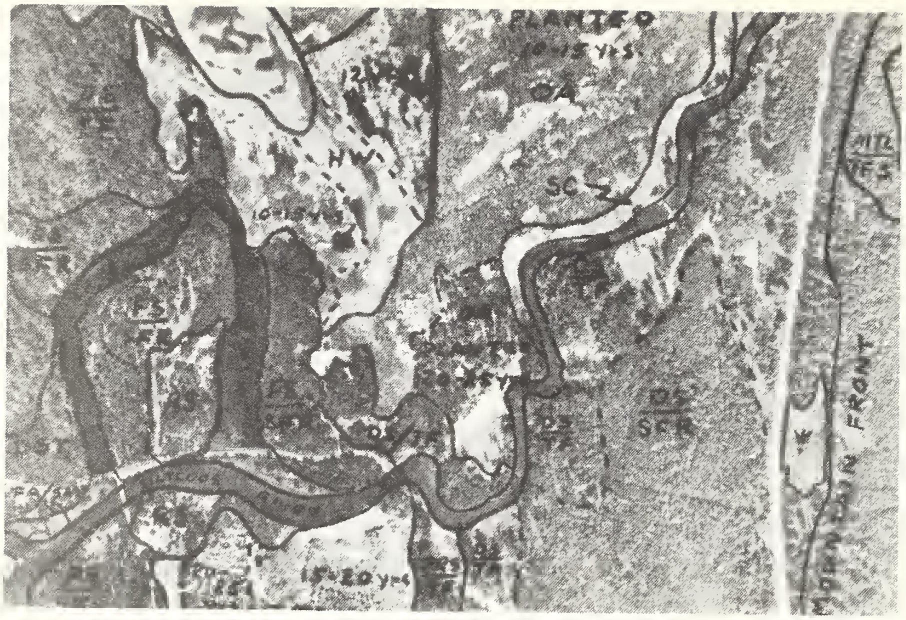
The riparian forests provide a "buffer" which reduces the amount of harassment waterfowl, shorebirds and wading birds receive from human activities. Beaver, otter and muskrat depend on these riparian forests for food and cover. The osprey and bald eagle, endangered and rare birds, perch on the snags adjacent to streams when fishing.

These areas are similar to the Deflation Plain, shorepine forest, (DST), except that there is a greater variety of plant life with taller trees and more diverse and colorful understories. They do not, however, invite use since the understories are usually impenetrable.

Factors important to management include the recognition of the water table fluctuations, the hazard of streambank erosion, the clearings required for human occupancy or use, and their importance to wildlife.

View of Flood Plain, stabilized; Transition Forest (FS/TF). Note the proximity to the stream course and the opportunity for the lands to provide sanctuaries for birds and mammals. Flooding and fluctuating water tables are inherent to these areas.

View of the FS/TF in the background.



View of Flood Plain, stabilized; shorepine forest of stabilized dunes (FS/SFR). Note that these areas often include grassy meadows as well as wet marshy areas since they occupy positions strongly influenced by water table fluctuations.

View of the fringe of the FS/SFR on the left, right, and background. Major portions of the stabilized flood plain are critical wildlife habitats because they support a diversity and abundance of wildlife.

Flood plain, stabilized, Transition Forest (FS)/(TF)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Major portions are critical wildlife habitat (near streams)* b. Seasonal flooding or high water table c. Modification of charac. landscape	2	5	4	a. None b. Streambank protection & land fill c. Careful location & design	a. -- b. Loss of critical wildlife habitat c. --
Parking Lots	a. Major portions are critical wildlife habitat (near streams) b. Seasonal flooding or high water table c. Modification of charac. landscape	2	5	4	a. None b. Streambank protection & land fill c. Design to fit landscape	a. -- b. Loss of critical wildlife habitat c. Decrease in density
Drain-fields	a. High water table & seasonal flooding b. Estuary pollution hazard c. Major portions are critical wildlife habitat (near streams) d. Modification of charac.landscape	5	5	4	a. Land fill b. Sewage collection system c. None d. Limit size & clearing	a. Slight visual impact b. Disposal site limitations c. -- d. Limited capactity
Camp-grounds (24-hr. occup.)	a. Seasonal flooding or high water table b. Major portions are critical wildlife habitat (near streams) c. Modification of charac. landscape	3	5	3	a. Streambank protection & land fill b. None c. Careful design	a. Loss of critical wildlife habitat; slight visual impact b. -- c. --
Human Occupancy (Day use)	a. Seasonal flooding or high water table b. Major portions are critical wildlife habitat (near streams) c. Modification of charac. landscape	3	5	3	a. Streambank protection & land fill b. None c. Careful design	a. Loss of critical wildlife habitat: slight visual impact b. -- c. --
Human Occupancy (Ped. access)	a. Vegetation is natural barrier b. Critical wildlife habitat; harassment c. High water table (mostly seasonal consid.)	2	3	1	a. Provide reinforced trails b. None; I&E Program c. Avoid areas	a. Slight visual impact b. -- c. --

Flood plain, stabilized, Transition Forest (FS)
(TF)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Vegetation is natural barrier b. Major portions are critical wildlife habitat (near streams); harassment c. High water table (mostly seasonal consid.)	2	5	1	a. Provide reinforced trails b. Locate trails away from streams; I&E; Zone activity * c. Avoid areas	a. Slight visual impact b. Reduct. of rec. land base; some harassment will persist c. --
Cross-country Travel (vehicles)	a. Vegetation is natural barrier b. Major portions are critical wildlife habitat (near streams); harassment c. High water table (mostly seasonal consid.) d. Visual impact from trailing	5	5	3	a. Provide reinforced & drained trails (See Road Construction) b. Locate trails away from streams; I&E. Zone activity* c. Avoid areas d. Control	a. Loss of wildlife habitat b. -- c. -- d. Creation of roads
Buildings (Contin. found.)	a. High water table (bearing strength poor)(annual consid.) b. Major portions are critical wildlife habitat (near streams) c. Modification of charac. landscape	3	5	3	a. Land fill b. None c. Custom design	a. Loss of critical wildlife habitat, slight visual impact b. -- c. --
Buildings (Pole found.)	a. Major portions are critical wildlife habitat b. Opportunity for wildlife observation blind c. Modification of charac. landscape	2	5 2	3	a. None b. None c. Custom design	a. -- b. -- c. --
Powerline Tower Install.	a. Quant. of clearing required b. Occas. area of high water table c. Major portions are critical wildlife habitat d (near streams) d. Not compatible with charac. landscape	2	5	4	a. Design to fit landscape b. Avoid or use buried pipe c. None d. Buried pipeline	a. Loss of aesthetic values b. Visual impact c. -- d. Visual impact from clearing
Buried Pipeline Install.	a. Quant. of clearing required b. Occas. area of high water table c. Major portions are critical wildlife habitat (near streams) d. Modification of charac. landscape	2	5	3	a. Design to fit landscape b. Pumping & shoring required c. None d. Vary alignment & clearing	a. Loss of aesthetic values b. Safety hazard during construction c. -- d. --
Vegetative Stabiliz. (dunegrass)	a. Undesirable plant composition	4	5	3	a. Restore with original or adapt.spec.	a.--

*See wildlife overlays for critical habitat areas.

Flood plain, stabilized, shorepine forest of stabilized dunes $\frac{(FS)}{SFR}$

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Major portions are critical wildlife habitat (near streams) b. Seasonal flooding or high water table c. Modification of charac. landscape	2	5	4	a. None b. Streambank protection & land fill c. Careful design, varied alignments & clearing	a. -- b. Loss of critical wildlife habitat c. --
Parking Lots	a. Major portions are critical wildlife habitat (near streams) b. Seasonal flooding or high water table c. Modification of charac. landscape	2	5	4	a. None b. Streambank protection & landfill c. Careful design & placement	a. -- b. Loss of critical wildlife habitat c. Decreased density
Drainfields	a. High water table & seasonal flooding b. Estuary pollution hazard c. Major portions are critical wildlife habitat (near streams) d. Modification of charac. landscape	5	5 5	4	a. Land fill b. Sewage collection system c. None d. Decrease size & clearing	a. Modification of charac. landscape b. Disposal site limitation c. -- d. Decreased efficiency
Campgrounds (24-hr occup.)	a. Seasonal flooding or high water table b. Major portions are critical wildlife habitat (near streams) c. Modification of charac. landscape	3	5	3	a. Streambank protection & land fill b. None c. Careful location & design	a. Loss of wildlife habitat b. -- c. --
Human Occupancy (day use)	a. Seasonal flooding or high water table b. Major portions are critical wildlife habitat c. Modification of charac. landscape	3	5	3	a. Streambank protection & land fill b. None c. Careful location & design	a. Loss of wildlife habitat b. -- c. --
Human Occupancy (ped. access)	a. Vegetation is a natural barrier b. Critical wildlife habitat near streams; harassmt c. High water table (mostly seasonal consid.) d. Slight visual impact from trailing	2	3	2	a. Provide reinforced trails b. None; I&E Program c. Avoid areas d. Control	a. Slight visual impact b. -- c. -- d. --

Flood plain, stabilized, shorepine forest of stabilized dunes (FS)
(SFR)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. Vegetation is natural barrier b. Major portions are critical wildlife habitat (near streams); harassment c. High water table (mostly seasonal consid.) d. Slight visual impact from trailing	2	5	2	a. Provide reinforced trails b. Trails away from streams, I&E. Zone activity* c. Avoidance d. Control	a. Slight visual impact b. Reduct. of rec. land base; some harassment will persist c. -- d. --
Cross-country Travel (vehicle)	a. Vegetation is natural barrier b. Major portions are critical wildlife habitat (near streams), harassment c. High water table (mostly seasonal consid.) d. Modification of charac. landscape from trailing	5	5	4	a. Provide reinforced & drained trails (see road construction) b. Trails away from streams, I&E. Zone activity* c. Avoid areas d. Control	a. Loss of critical wildlife habitat; negative visual impact b. Reduct. of rec. land base; some harassment will persist c. -- d. Creation of roads
Buildings (Contin. found.)	a. High water table (bearing strength poor) annual consid. b. Major portions are critical wildlife habitat (near streams) c. Modification of charac. landscape	3	5	3	a. Land fill b. None c. Custom design	a. Loss of critical wildlife habitat, slight visual impact b. -- c.
Buildings (Pole found.)	a. Major portions are critical wildlife habitat (near streams) b. Opportunity for wildlife observation blind c. Modification of charac. landscape	2	5 2	3	a. None b. None c. Custom design	a. -- b. -- c. --
Powerline Tower Install.	a. Quant. of clearing required b. Occ. area of high water table c. Major portions are critical wildlife habitat (near streams) d. Modification of charac. landscape	2	5	4	a. Design to fit landscape b. Avoid or use buried pipe c. None d. Design to fit landscape	a. Loss of aesthetic values b. -- c. -- d. --
Buried Pipe Install.	a. Quant. of clearing required b. Occ. area of high water table c. Major portions are critical wildlife habitat (near streams) d. Modification of charac. landscape	2	5	4	a. Design to fit landscape b. Pumping & shoring required c. None d. Vary alignment and clearing	a. Loss of aesthetic value b. Safety hazard during construction c. -- d. --
Vegeta. Stabiliz. (Dunegr.)	a. Undesirable plant composition	4	5	3	a. Restore with orig. or adapt. species	a. --

* See wildlife overlays for critical habitat areas

Mountain Front; shoreline marsh (MSM): This feature occurs within the mountain front landscape, adjacent to the lakes where is is strongly influenced by the surface drainage waters from the headlands and the lake water levels. It is level, marshy and often covered with aquatic plants. These areas comprise approximately .31 percent of the total area.

The lake shoreline marshes are wet year around with rare low-water periods resulting from very dry years. The following species are found in this marsh: cat-tail, bulrush, water lily, and Brazilian water weed. Alder and willow, skunk cabbage and slough sedge are found around the periphery of these marshes.

Shoreline marshes are critical habitats for aquatic mammals, waterfowl, shorebirds, wading birds, fish and amphibians. These marshes are used by 58 species--42 birds, 7 mammals, 8 amphibians, and 1 reptile. Beaver, mink, otter and muskrat are common residents of these marshes. Thirty-six species of waterfowl, shorebirds and wading birds feed or nest in shoreline marshes. During peak periods of use, November to March, it is not uncommon to see several thousand waterfowl in the larger marshes. These are important spawning areas for bluegill, bass and other warm water species of fish. Decaying marsh vegetation introduces nutrients and organic matter into the water, stimulating the growth of plankton. The marsh vegetation teems with insects. The plankton and insects, very rich food sources, make these marshes important rearing areas for many species of fish. Frogs and salamanders breed in these marshes.

Since it is commonly under water, it does not invite human use except for fishing opportunities. The major consideration in the management of these marshes are their value as wildlife habitat.

View of Mountain Front; shoreline marsh (MSM). These lands are affected by upslope run-off waters and the lake levels. Shoreline marshes are important spawning and rearing areas for many species of fish.

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Road Construction	a. High water table (annual consideration) b. Flooding hazard c. Not compatible with charac. landscape d. Loss of critical wildlife habitat; harassment	4	5	4	a. Turnpike or bridge b. Through-flow design c. None d. None	a. Loss of critical wildlife habitat; harassment; neg. visual impact b. -- c. -- d. --
Parking Lots	a. High water table (annual consideration) b. Flooding hazard c. Not compatible with charac. landscape d. Loss of critical wildlife habitat; harassment	4	5	5	a. Land fill, revetments b. Through-flow design c. None d. None	a. Loss of critical wildlife habitat; harassment; neg. visual impact b. -- c. -- d. --
Drain-fields	a. High water table (annual consideration) b. Loss of critical wildlife habitat c. Modification of charac. landscape (clearing)	5	5	4	a. Sewage collection system b. None c. Limit clearing size	a. Disposal site limitations b. -- c. Decrease in efficiency
Camp-grounds (24-hr. occupancy)	a. High water table (annual consideration) b. Flooding hazard c. Not compatible with charac. landscape d. Loss of critical wildlife habitat; harassment	5	5	5	a. Land fill b. Through-flow design c. None d. None; I&E Program	a. Loss of critical wildlife habitat; harassment b. -- c. -- d. --
Human Occupancy (Day-use)	a. High water table (annual consid.) b. Flooding hazard c. Visual impact d. Loss of critical wildlife habitat; harassment e. Mosquito habitat	5	5	4	a. Land fill b. Through-flow design c. None d. None e. Biological control	a. Loss of critical wildlife habitat; harassment; neg. visual impact b. -- c. -- d. -- e. --
Human Occupancy (Ped. access)	a. High water table (annual consideration) b. Critical wildlife habitat; harassment c. Mosquito habitat	5	3	3	a. Boardwalks, bridging b. I&E Program c. Biological control	a. Loss of critical wildlife habitat; slight visual impact a. Some harassment will persist c. --

Mtn. Front, Shoreline Marsh (MSM)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Cross-country Travel (horses)	a. High water table (annual consideration) b. Critical wildlife habitat; harassment c. Mosquito habitat	5	5	3	a. Boardwalk, bridging b. I&E Program c. Biological control	a. Loss of critical wildlife habitat; moderate visual impact b. --- c. --
Cross-country Travel (vehicles)	a. High water table (annual consideration) b. Critical wildlife habitat; harassment; c. Mosquito habitat d. Visual incompatibility of trailing effect	5	5	4	a. Turnpike trails b. I&E Program c. Biological control d. Control of travel routes	a. Loss of critical wildlife habitat; negative visual impact b. -- c. -- d. -- Creation of roads
Buildings (Contin. found.)	a. High water table (annual consid.) b. Not compatible with charac. landscape c. Loss of critical wildlife habitat	5	5	5	a. Land fill b. None c. None	a. Loss of critical wildlife habitat; visual impact b. -- c. --
Buildings (Pole found.)	a. Not compatible with charac. landscape b. Loss of critical wildlife habitat	3	5	5	a. None b. None	a. -- b. --
Powerline Install.	a. High water table (annual consideration) b. Not compatible with charac. landscape c. Loss of critical wildlife habitat	2	5	5	a. Land fill b. None c. None	a. Loss of critical wildlife habitat: neg. visual impact b. -- c. --
Buried Pipeline Install.	a. High water table (annual consideration) b. Loss of critical wildlife habitat	2	5	1	a. ? b. None	a. -- b. --
Vegetative Stabiliz. (Dunegrass)	a. High water table (annual consideration)	5		5	a. None	a. --

Mountain Front; marshy, valley fill (MMV): This feature occurs within the mountain front landscape at the lower reaches of the drainageways that carry the surface waters from the headlands. It blends into the narrow drainageways (MDW) on the upper ends and usually into the shoreline marsh at the lower ends. It is level to nearly level and water moves through the landscape on its way downslope. It includes marshy areas, meadows, defined channels and ill-defined channels. It comprises approximately .33 percent of the total area.

Plant species associated with this marshy area are: slough sedge, skunk cabbage, red flowering currant, and salmonberry. The periphery of the marsh supports willow, alder, and occasional western redcedars.

The marshy valley fill is a critical wildlife habitat, especially for aquatic mammals, salamanders and certain wading birds. It is used by 88 wildlife species--66 birds, 21 mammals, 8 amphibians and 3 reptiles. Streams passing through the marsh valley fill are migration routes for resident and anadromous salmonoids. These marshy areas produce nutrients and organic matter which contribute to the fertility of adjacent lakes. Since it is commonly under water, it does not invite human use.

Some of the factors important to management include (1) it is a critical wildlife habitat, and (2) it has a certain degree of susceptibility to sediment - causing activities such as roadbuilding.

View of Mountain Front; marshy vally fill (MMV), in the lower left corner. These lands have a very slight gradient and carry the run-off waters from the upper slopes. South end of Siltcoos Lake. Salamanders and many species of warblers prefer this habitat.

Mtn. Front, Marshy Valley Fill (MMV)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. High water table (annual consideration) b. Flooding hazard c. Not compatible with charac. landscape d. Loss of critical wildlife habitat; harassment	5	5	4	a. Turnpike or bridge b. Through-flow design c. None d. None	a. Loss of critical wildlife habitat; harassment; neg. visual impact b. -- c. -- d. --
Parking Lots	a. High water table (annual consideration) b. Flooding hazard c. Not compatible with charac. landscape d. Loss of critical wildlife habitat; harassment	5	5	5	a. Land fill b. Through-flow design c. None d. None	a. Loss of critical wildlife habitat; harassment; neg. visual impact b. -- c. -- d. --
Drainfields	a. High water table (annual consideration) b. Loss of critical wildlife habitat c. Modification of charac. landscape	5	5	5	a. Sewage collection system b. None c. Limit clearing	a. Disposal site limitation b. -- c. Decrease in efficiency
Campgrounds (24-hr. occup.)	a. High water table (annual consideration) b. Flooding hazard c. Not compatible with characteristic landscape d. Loss of critical wildlife habitat; harassment e. Mosquito habitat	5	5	5	a. Land fill b. Through-flow design c. None d. None e. Biological control	a. Loss of critical wildlife habitat; harassment; neg. visual impact b. -- c. -- d. -- e. --
Human Occupancy (Day-use)	a. High water table (annual consideration) b. Flooding hazard c. Visual impact d. Loss of critical wildlife habitat; harassment e. Mosquito habitat	5	5	4	a. Land fill b. Through-flow design c. Specialized design d. None e. Biological control	a. Loss of critical wildlife habitat; harassment; neg. visual impact b. -- c. -- d. -- e. --
Human Occupancy (Ped. access)	a. High water table (annual consideration) b. Critical wildlife habitat; harassment c. Mosquito habitat	5	3	3	a. Boardwalk, bridging b. I&E Program c. Biological control	a. Loss of critical wildlife habitat; neg. visual impact b. Some harassment will persist c. --

Mtn. Front, marshy valley fill (MMV)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. High water table (annual consideration)	5			a. Boardwalk, bridging	a. Loss of critical wildlife habitat neg. visual impact
	b. Critical wildlife habitat; harassment		5		b. I&E Program	b. --
	c. Mosquito habitat				c. Biological control	c. --
	d. Visual impact from trailing effect			3	d. Admin. control of travel routes	d. --
Cross-country Travel (vehicles)	a. High water table (annual consideration)	5			a. Turnpike trails, bridging	a. Loss of critical wildlife habitat; neg. visual impact
	b. Critical wildlife habitat; harassment		5		b. I&E Program	b. --
	c. Mosquito habitat				c. Biological control	c. --
	d. Visual incompatibility of trailing effect			4	d. Control of travel routes	d. Creation of roads
Buildings (Contin. found.)	a. High water table (annual consideration)	5			a. Land fill	a. Loss of critical wildlife habitat; neg. visual impact
	b. Flooding hazard				b. Pole foundation	b. Loss of critical wildlife habitat; neg. visual impact
	c. Not compatible with charac. landscape			5	c. None	c. --
	d. Destruction of critical wildlife habitat		5		d. None	d. --
Buildings (Pole found.)	a. Not compatible with charac. landscape	4		4	a. None	a. --
	b. Loss of critical wildlife habitat		5		b. None	b. --
Powerline Tower Install.	a. High water table (annual consideration)	3			a. Land fill	a. Loss of critical wildlife habitat; neg. visual impact
	b. Not compatible with charac. landscape			3	b. None	b. --
	c. Loss of critical wildlife habitat		5		c. None	c. --
Buried Pipeline Install.	a. High water table (annual consideration)	3			a. ?	a. --
	b. Loss of critical wildlife habitat		5		b. None	b. --
	c. Temp. modification to charac. landscape			3	c. None	c. --
	d. Water erosion hazard				d. None	d. --
Vegetative Stabiliz. (Dunegrass)	a. High water table (annual consideration)	5		5	a. None	a. --

Mountain Front; narrow drainageway (MDW): This feature occurs within the mountain front landscape in the dissected drainageways that carry the surface and subsurface waters from the steeper slopes. It blends into the marshy valley fill (MMV) at the lower end and grades into the steep side slopes (MSS) at the upper reaches. It is gently sloping with gradients of 2 to 20 percent, but more commonly 2 to 5 percent. It comprises approximately .33 percent of the area. The narrow drainageway follows a stream course and its vegetation reflects the plant communities found growing in the vicinity of the stream. It combines stretches where the vegetation is essentially that of the forest type growing on the site to "marshy" segments where the vegetation is represented by: western redcedar, willow, alder, slough sedge, skunk cabbage, red-flowering currant, salmonberry, and fern species. In the National Recreation Area, all of the narrow drainageways occur within a second growth transition forest type where the following tree species are found: sitka spruce, shorepine, western hemlock, western redcedar, and Douglas-fir. Shrub species, among others, are: rhododendron, evergreen huckleberry, trailing blackberry, salmonberry, thimbleberry, and species of fern.

Narrow drainageways are critical wildlife habitats for a variety of reasons. Steelhead trout, coho salmon and searun or resident cutthroat trout use many of the streams for spawning and rearing areas. The streambank and adjacent vegetation are the preferred habitats of the white-footed vole, a rare mammal in Oregon. Aquatic mammals, mink, beaver, muskrat and otter are common. It is an important breeding area for salamanders; all eight species present on the N.R.A. are found in this one habitat. Birds and mammals from the surrounding areas concentrate their activities near the stream. The drainageways form a natural travel route that is used by many mammals.

Since water flows through these areas and limited meadow-like conditions are found, it does invite some human use for the purpose of fishing or watching the water tumble downstream.

Some factors important to the management of narrow drainageways include: (1) its status as a critical wildlife habitat and (2) the vulnerability of the streams and fisheries resources to sedimentation resulting from a variety of soil-disturbing activities.

View of Mountain Front, narrow drainageways (MDW) that carry the run-off waters from the uplands. Streams in certain drainageways are important spawning and rearing ares for steelhead trout, coho salmon, and searun or resident cutthroat trout.

Mtn. Front, narrow drainageway (MDW)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Interference with water movement	5			a. Provide adequate drainage, bridging	a. Loss of critical wildlife habitat; harassment
	b. Sediment entering stream from construc.				b. End haul excavated material	b. Waste site needed
	c. Cutbank and fill slope failure hazard				c. Design, compaction ...	c. --
	d. Loss of critical wildlife habitat; harassment		5		d. Perpendicular crossing by bridging; I&E	d. Loss of some wildlife habitat
	e. Flooding and water erosion hazard				e. Binwalls, gabions, riprap	e. Destruction of critical wildlife habitat
	f. High water table (poor bearing strength)				f. Ballast and land fill	f. Destruction of critical wildlife habitat; neg. visual impact
	g. Modification of charac. landscape			4	g. Careful location & design	g. Destruction of critical wildlife impact
Parking Lots	a. Lack of surface area	5			a. Specialized design	a. Decreased capacity
	b. High water table (poor bearing strength)				b. Land fill, revetments	b. Loss of critical wildlife habitat; harassment; neg. visual impact
	c. Flooding and water erosion hazard				c. Binwalls, gabions, riprap	c. Loss of critical wildlife habitat; harassment; neg. visual impact
	d. Loss of critical wildlife habitat; harassment		5		d. None	d. --
	e. Modification of charac. landscape			4	e. Specialized design	e. Decreased capacity
Drainfields	a. Lack of surface area; clearing required	5		4	a. Sewage collection system	a. Disposal site limitation
	b. High water table				b. None	b. --
	c. Flooding and water erosion hazard				c. None	c. --
	d. Pollution hazard to stream				d. None	d. --
	e. Loss of critical wildlife habitat		5		e. None	e. --
Campgrounds (24-hr. occupancy)	a. Lack of surface area	4			a. Specialized design	a. Decreased capacity
	b. High water table (poor bearing strength)				b. Land fill, revetments	b. Loss of critical wildlife habitat; harassment; neg. visual impact
	c. Flooding and water erosion hazard				c. Binwalls, gabions, riprap	c. Loss of critical wildlife habitat; harassment; neg. visual impact
	d. Loss of critical wildlife habitat; harassment		5		d. None	d. --
	e. Modification of charac. landscape			4	e. Specialized design	e. Decreased capacity
Human Occupancy (Day use)	a. Lack of surface area	3			a. Specialized design	a. Decreased capacity
	b. High water table (poor bearing strength)				b. Land fill revetments	b. Loss of critical wildlife habitat; harassment; neg. visual impact
	c. Flooding and water erosion hazard				c. Binwalls, gabions, riprap	c. Loss of critical wildlife habitat; harassment; neg. visual impact
	d. Loss of critical wildlife habitat and harassment		5		d. None	d. --
	e. Modification of charac. landscape			3	e. Specialized design	e. Decreased capacity
Human Occupancy (Ped. access)	a. High water table (poor bearing strength)	3			a. Boardwalks, bridging required	a. Destruction & harassment in a critical wildlife habitat; neg. visual impact
	b. Rutting will occur			3	b. Boardwalks, bridging required	b. Destruction & harassment in a critical wildlife habitat; neg. visual impact
	c. Trails required				c. Boardwalks, bridging required	c. --
	d. Critical wildlife habitat; harassment		3		d. I&E Program	d. Some harassment will persist

Mtn. Front, 'narrow drainageway (MDW)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. High water table (poor bearing strength)	4			a. Boardwalks, bridging required	a. Loss of critical wildlife habitat; neg. visual impact
	b. Rutting will occur			3	b. Boardwalks, bridging required	b. Loss of critical wildlife habitat; neg. visual impact
	c. Trails required				c. Boardwalks, bridging required	c. Loss of critical wildlife habitat; neg. visual impact
	d. Critical wildlife habitat; harassment		5		d. I&E Program	d. --
Cross-country Travel (vehicles)	a. High water table (poor bearing strength)	5			a. Boardwalks, bridging required	a. Loss of critical wildlife habitat; neg. visual impact
	b. Rutting will occur				b. Boardwalks, bridging required	b. Loss of critical wildlife habitat; neg. visual impact
	c. Trails required				c. Boardwalks, bridging required	c. Loss of critical wildlife habitat; neg. visual impact
	d. Critical wildlife habitat; harassment		5		d. I&E Program	d. --
	e. Visual impacts to charac. landscape			4	e. None	e. --
Buildings (Contin. found.)	a. High water table (poor bearing strength)	4			a. Land fill, revetments	a. Loss of critical wildlife habitat; neg. visual impact
	b. Flooding and water erosion hazard				b. Binwalls, gabions, riprap	b. Loss of critical wildlife habitat; neg. visual impact
	c. Loss of critical wildlife habitat		5		c. None	c. --
	d. Modification to charac. landscape			3	d. Specialized designs	d. --
Buildings (Pole found.)	a. Loss of critical wildlife habitat	3	5		a. None	a. --
	b. Modification to charac. landscape			3	b. Specialized designs	b. --
Powerline Tower Install.	a. A high water table (poor bearing strength)	4			a. Land fill revetments	a. Loss of critical wildlife habitat; neg. visual impact
	b. Flooding and water erosion hazard				b. Binwalls, gabions, riprap	b. Loss of critical wildlife habitat; neg. visual impact
	c. Not compatible with charac. landscape			5	c. None	c. --
	d. Loss of critical wildlife habitat if located parallel to beach		5		d. Perpendicular crossing; do not disturb vegetation	d. --
Buried Pipeline Install.	a. High water table	4			a. Corrosion-resistant pipe	a. --
	b. Sediment entering stream				b. Equipment restrictions	b. --
	c. Loss of critical wildlife habitat		5		c. Perpendicular crossing; restore vegetation	c. Temporary habitat loss
	d. Modification of landscape					
	d. Modification of landscape			4	d. Varied alignment and clearings	d. --
Veg. Stab. (Dunegrass)	a. Undesirable plant community	5		5	a. Use native species	a. --

Mountain Front, steep side slope (MSS): These geomorphic-plant community areas occur within the mountain front landscape on slopes in excess of 20 percent. On the seaward side, these slopes are blanketed with a deep (10 feet plus) windborne deposit of sand, overlying weathered sandstone and shale bedrock. On the inland side, the windborne sand can still be found but is much thinner, often less than 2 feet thick. Slopes vary from 20 to greater than 60 percent, with vertical relief of 500 feet above sea level and in some places over 400 feet within a half-mile horizontal distance. These landforms are highly dissected with narrow intermittent and perennial drainageways. Surface runoff is relatively rapid and there is seldom significant soil accumulations in the drainageways to serve as a buffer or water retention medium. These areas comprise approximately 11.8 percent of the total area.

Transition Forest (MSS/TF): The only stand within the N.R.A. where we find the uncut transition forest on the mountain front soil is in the Threemile Creek Area. The trees of this forest type are much larger here than the same forest type growing on stabilized sand. The tree canopy is dense and little or no shrubs grow under the trees. The dominant trees are sitka spruce and Douglas-fir with occasional shorepine, hemlock, and western redcedar. The shrubs growing in openings or at the fringe of the forest are: rhododendron, evergreen hucklegerry, salal, trailing blackberry, salmonberry, thimbleberry, sword and bracken ferns.

The uncut transition forest found on the steep side slopes of the mountain front is similar to older second growth (26 to 50 years) transition forest. The same species of wildlife inhabiting or using the older second growth of the transition forest will be found in uncut transition forest.

Uncut transition forest is inhabited by 70 species: 32 birds, 28 mammals and 10 amphibians. Because the habitat does not have a shrub layer, only 29 species of songbirds are present. The golden-crowned kinglet, chestnut-backed chickadee and brown creeper may be found in this habitat. The California red-back vole, chickaree and deer mice are relatively common in uncut transition forest. While none are abundant, all 8 species of salamander on N.R.A. may be found in this habitat.

Transition Forest Old Growth (MSS/TFO): There are remnant stands of old-growth trees. There are two stands of old growth on mountain front soil, both in the vicinity of Threemile Creek. The trees are very large, attaining diameters of 3-4 feet DBH and heights of 100 feet plus. Sitka spruce, Douglas-fir and western hemlock are the most numerous trees of old-growth stands, with occasional western redcedar. The shrub layer is shaded out under the closed canopy of the trees. Some rhododendron, evergreen huckleberry, salal and ferns are found along the fringe of the stands.

Remnant stands of old growth are a critical habitat for certain species of wildlife. The larger birds of prey--bald eagle, osprey, red-tailed hawk and great horned owl use these stands for perching or roosting. The bald eagle and osprey are considered rare or endangered birds. While none of these species were found nesting in old growth, they all favor the large

trees or snags as nesting sites. The great blue heron, a colonial nester, requires stands of large trees for nesting. An active heron rookery exists in a pocket of old growth adjacent to the southern boundary of the N.R.A.

The large trees in old-growth stands are potential snags. Snags are very important to cavity nesting birds, birds of prey and certain mammals. It may take 125 years for a tree to grow to a size suitable for nesting by great blue herons or bald eagles. An additional lengthy period of time may pass before it becomes a snag suitable for cavity nesting species. These species are dependent on the continuous availability of snags.

Old-growth stands are used by 96 species of wildlife -- 55 birds, 28 mammals, 11 amphibians, and 2 reptiles. Many of these species also inhabit the surrounding forest types. None of these species are abundant in stands of old growth. The eight species of salamanders found on the N.R.A. may be expected to use this habitat. The pileated woodpecker, one of the largest woodpeckers in North America, uses this habitat. Other species inhabiting stands of old growth are the hairy woodpecker, brown creeper, great horned owl, red-tailed hawk, flying squirrel, California red-backed vole and chickaree.

Transition Forest Clearcut (MSS/TFC): These are logged-over stands, ranging from 2 to 12 years. Shrub species are the undisputed dominants of the older clearcuts. Shrubs and grasses are important components of younger clearcuts and in the openings of older ones. Some of the shrubs found in clearcuts are: rhododendron, evergreen huckleberry, salal, trailing blackberry, sword fern, bracken fern, etc. Depending on the site, seed source, or planting stock, the stand will have any of the five species of trees found in the transition forest.

Clearcuts occurring in the transition forest are inhabited or used by 96 species--61 birds, 27 mammals, 5 amphibians, and 3 reptiles. The lush growth of grasses, herbs and shrubs in recent clearcuts provides an abundance of food and cover for many small mammals. Populations of deer mice, Oregon voles, Townsend chipmunks and brush rabbits increase to high levels. These small mammals attract coyotes, bobcats, great horned owls and other predators. Black-tailed deer concentrate their feeding activities in clearcuts because of the abundance of palatable browse. As the salmonberry, elderberry, huckleberry and salal shrubs mature they start producing fruit. These berries attract bears, band-tailed pigeons, mountain quail and many species of songbirds. At approximately 12 years after logging,the trees and shrubs shade out much of the ground cover. Some species of small mammals dependent on this ground cover decrease in number or are eliminated. The clearcut has become a young, second-growth forest. Different species of wildlife now move in, replacing those eliminated by the growth of trees and shrubs. However, many species of wildlife are common to both clearcuts and young second growth.

Transition Forest Second Growth (MSS/TFS): This stage of the transition forest is found between Highway 101 and the west shore of Siltcoos and Tahkenitch Lakes, and also between the east boundary of the N.R.A. and Threemile Lake. The age of the stands vary from approximately 13 to 50 years, since cutting and the size of the trees range from 10-foot saplings to 75-foot trees. The overstory composition varies from pure stands of sitka spruce, hemlock, or Douglas-fir, to mixtures of all three species with scattered shorepine and

western redcedar. In young stands, the shrub layer is an important component of the forest, but in older stands the shrub layer is completely shaded out. Rhododendron, salal, evergreen huckleberry, trailing blackberry, sword fern, bracken fern, etc., are the most common shrubs in second-growth forests.

The numbers and kinds of wildlife species inhabiting second-growth transition forest is dependent on the age of the forest. Younger second growth (13-25 years after logging) has a well developed shrub layer. In older second growth (26-50 years) this shrub layer is absent or being shaded out by the dense tree canopy. The presence of this shrub layer is primarily responsible for the greater number of species, especially birds, found in younger second growth. The transition from young to older second growth is gradual and many of the same species of wildlife are found in both; the major difference being a change in abundance or degree of use. Other species are found only in one stage of second growth.

Younger second growth is inhabited by 102 species--66 birds, 28 mammals, 5 amphibians and 3 reptiles. Songbirds, 57 species, are relatively abundant in this stage. Black-tailed deer, chickarees, Townsend chipmunks, brush rabbits, deer mice, purple finches, steller's jays, clouded salamanders, and northern alligator lizards are common residents of young second growth.

Older second growth is the habitat of 70 species--32 birds, 28 mammals and 10 amphibians. Relatively few songbirds, 29 species, use this habitat. Black-tailed deer, deer mice, and Townsend chipmunks are present but in considerably fewer numbers than in young second growth. Brush rabbits and northern alligator lizards are not usually present. The California red-back vole is a common resident of older second growth. An uncommon and unique species, the red tree mouse is found only in the older stands. All eight species of salamanders on the N.R.A. can be found in this habitat.

Since these landscapes are common to the coast range, occupy steep slopes and have dense, impenetrable understories, they offer little incentive to visitor use.

Two factors important to management include consideration of the mantle stability and other characteristics in relation to road construction, and their value as wildlife habitats.

Excavated materials that are sidecast on the headwalls or within the drainageway portion of the landscape are subject to mass movement and, therefore, stream sedimentation. Since exposed soil and bedrock is quite light in color and contrasts strongly with the vegetative color, extensive excavations can be seen for many miles.

These remnant stands of old growth are very small but also very important to wildlife, especially birds of prey and great blue herons. Birds of prey use these stands as roosting and perching sites. These stands are also potential nesting sites for these species.

View of the Mountain Front, steep side slopes (MSS) with Transition Forest, second growth (TFS) vegetation cover. South end of Siltcoos Lake.

View of clearcut area being occupied by brush species.

View of second growth overstory (MSS/TFS).

Mountain Front Steep Side Slope Transition Forest (MSS/TF)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Susceptible to mass movement, back slope & drainageway fills b. Road ditch erosion c. Steep slopes requiring extensive excavation d. Modification at char. landscape e. Loss of wildlife habitat, especially snags	4	4	4	a. Locate on stable ground; install bin walls b. Reinforce ditches & dispersion joints; outslope road c. Minimal road widths d. Careful locat. min. width, cut & fill e. Limit no. of visitors, retain snags	a. Problems will still persist; visual impacts b. Erosion of fit slopes c. Safety hazard (traffic) d. Limited traffic volume e. Reduction of recreation base
Parking Lots	a. Slopes generally in excess of 20% b. Susceptible to mass movement c. Surface run-off d. Surface area lacking e. Modification of charac. landscape f. Loss of wildlife habitat, esp. snags	5	4	5	a. Locate on steeper slopes b. Locate on stable ground c. Reinforce drainage dispersion point d. Massive excavation e. Specialized design f. None	a. Decrease in density, incr. in cost b. -- c. -- d. Neg. veg. impact; mass movement & waste disposal e. Limited density f. --
Drainfields	a. Excessive slopes b. Not compatible with char. landscape	5	1	5	a. Sew collection system b. Limit size & clearing	a. Disposal site limitation b. Limit. capacity
Campgrounds (24-hr. Occup.)	a. Surface area lacking b. Slopes generally in excess of 20% c. Modification of char. landscape d. Loss of wildlife habitat, esp. snags	5	4	4	a. Massive excavation b. Terraces w/bin walls c. Specialized design d. None	a. Neg. visual impact; mass movement & waste disposal b. Neg. vis. impact; decr. in density c. Decrease in density, inc. in cost d. --
Human Occup. (Day Use)	a. Surface area lacking b. Slopes generally in excess of 20% c. Modification of char. landscape d. Loss of wildlife, esp. snags	4	4	4	a. Massive excavation b. Terraces w/bin walls c. Specialized design d. None	a. Neg. vis. imp; mass movement & waste disposal b. Neg. vis. impact; decr. in density c. Decrease in density, inc. in cost
Human Occup. (Ped. Access)	a. Vegetation is natural barrier b. Steep side slopes c. Wildlife harassment	3	2	1	a. Provide reinforced & drained trails b. Maintain low gradients c. I & E Program	a. Visual impact b. Potentials visual impact c. Some harassment will persist

Mountain Front Steep Side Slope Transition Forest (MSS/TF)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Vegetation is natural barrier b. Steep side slope c. Wildlife harassment	3	3	1	a. Provide reinforced & drained trails b. Maintain low gradients c. I & E Program	a. Visual impact b. Potential visual impact c. Some harassment will persist
Cross-Country Travel (Vehicles)	a. Vegetation is natural barrier b. Steep side slopes c. Visual impact of trailing d. Wildlife harassment	4	3	3	a. Provide reinforced & drained trails (see road construc.) b. Maintain low gradients c. Admin. control d. I & E Program	a. Source of surface run-off b. " " " " c. Creation of roads d. Some harassment will persist
Buildings (Contin. Found.)	a. Steep slopes b. Modification of char. landscape	4		4	a. Custom planning b. Careful location; custom design	a. -- b. --
Buildings (Pole Found.)	a. Steep slopes b. Modification of char. landscape	4		4	a. Custom planning b. Careful location; custom design	a. -- b. --
Powerline Tower Install.	a. Quantity of clearing swath required b. Not compatible with char. landscape c. Loss of wildlife habitat, especially snags	3	4	4	a. Design to fit landscape; place by helicopter b. Careful location; buried pipelines c. None	a. b. visual impact c. --
Buried Pipeline Install.	a. Quant. of clearing swath required b. Steep slopes - machinery limitations c. Modification of char. landscape d. Mass movement hazard e. Shallow soils f. Loss of wildlife habitat, esp. snags	4	4	3	a. Design to fit landscape b. Special design c. Vary alignment & clearing d. None e. Erosion control f. None	a. -- b. -- c. -- d. -- e. -- f. --
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant composition	5		5	a. Restore w/natives or adapt species	a. --

Mountain Front, Steep Side Slope, Transition Forest, Old Growth (MSS/TFO)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Susceptible to mass movement, backsloped & drainageway fills b. Road ditch erosion c. Steep slopes requiring extensive excavation d. Modification of char. landscape e. Loss of critical wildlife habitat	4	5	4	a. Locate on stable ground; install bin walls b. Reinforce ditches & dispersion joints, outslope road c. Minimal road widths d. Minimize clearing, cut & fill e. None	a. Problems will still persist b. Erosion of fill slopes c. Safety hazard (traffic) d. Limited traffic volume e. --
Parking Lots	a. Slopes generally in excess of 20% b. Susceptible to mass movement c. Surface run-off d. Surface area lacking e. Loss of critical wildlife habitat f. Modification of char. landscape	5	5	4	a. Locate on steeper slope b. Locate on stable ground c. Reinforce drainage dispers. points d. Massive excavation e. None f. Minimize clearing, cut & fill	a. Decrease in density, inc. in cost b. -- c. -- d. Neg. veg. impact; mass mvmnt. & waste disposal e. -- f. Limit density
Drainfields	a. Excessive slopes b. Negative visual impact c. Loss of critical wildlife habitat	5	5	4	a. Sew. collection system b. None c. Sew. collection system	a. Disposal site limitations b. -- c. Disposal site limitations
Campground (24-hr. Occup.)	a. Surface area lacking b. Slopes generally in excess of 20% c. Modification of char. landscape d. Loss of critical wildlife habitat	4	5	3	a. Massive excavation b. Terraces w/bin walls c. Specialized design d. None	a. Neg. vis. impact; mass mvmnt. & waste disposal b. Neg. vis. impact; decr. in density c. Decreased density, incr. cost d. --
Human Occup. (Day Use)	a. Surface area lacking b. Slopes generally in excess of 20% c. Modification of char. landscape d. Loss of critical wildlife habitat	4	5	3	a. Massive excavation b. Terraces w/bin walls c. Specialized design d. None	a. Neg. vis. impact; mass mvmnt. & waste disposal b. Neg. vis. impact; decr. in density c. Decreased density, incr. cost d. --
Human Occup. (Ped. Access)	a. Vegetation is natural barrier b. Steep side slopes c. Wildlife harassment	3	2	1	a. Provide reinforced & drained trails b. Maintain low gradients c. I & E Program	a. Visual impact b. Potential visual impact c. --

Mountain Front, Steep Side Slope, Transition Forest, Old Growth (MSS/TFO)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Vegetation is natural barrier b. Steep side slopes c. Wildlife harassment	3	 2	1	a. Provide reinforced & drained trails b. Maintain low gradients c. I & E; restrict to trails	a. Visual impact b. Potential visual impact c. Some harassment will persist
Cross-Country Travel (Vehicles)	a. Vegetation is natural barrier b. Steep side slopes c. Modification of char. landscape by trailing d. Wildlife harassment	4	 2	 3	a. Provide reinforced & drained trails (see road construc.) b. Maintain low gradients c. Controls d. I & E; restrict to trails	a. Source of surface run-off b. " " " " c. Creation of roads d. Some wildlife harassment will persist
Buildings (Contin. Found.)	a. Steep slopes b. Modification of char. landscape c. Loss of critical wildlife habitat	4	 5	 4	a. Custom planning b. Custom design; careful location c. None	a. -- b. limited locations c. --
Buildings (Pole Foundation)	a. Steep slopes b. Modification of char. landscape c. Loss of critical wildlife habitat	3	 5	 3	a. Design to fit landscape b. Custom design, careful location c. None	a. -- b. -- c. --
Powerline Tower Install.	a. Quantity of clearing swath required b. Not compatible with char. landscape c. Loss of critical wildlife habitat	3	 5	4 4	a. Design to fit landscape, place by helicopter b. Design to fit landscape, place by helicopter c. None	a. -- b. -- c. --
Buried Pipeline Install.	a. Quantity of clearing swath required b. Steep slope - machinery limitation c. Modification of char. landscape d. Loss of critical wildlife habitat e. Mass movement hazard f. Shallow soils	4	 5	 3	a. Design to fit landscape b. Special design c. Vary clearing alignment d. None e. None f. Erosion control	a. -- b. -- c. -- d. -- e. -- f. --
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant composition	5	5	5	a. Restore w/natives or adapt species	a. --

Mountain Front, Steep Side Slope, Transition Forest Clear Cut (MSS/TFC)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Susceptible to mass movement, backslope and drainageway fills b. Road ditch erosion c. Steep slopes requiring extensive excavation d. Modification of char. landscape e. Loss of wildlife habitat	4	2	5	a. Locate on stable ground; install bin walls b. Reinforce ditches & disposion pts, outslope road c. Minimal road widths d. Careful location & design e. Limit number of visitors	a. Problems will still persist b. Erosion of fill slopes c. Safety hazard (traffic) d. Reduction of recreation base e.
Parking Lots	a. Slopes generally in excess of 20% b. Susceptible to mass movement c. Surface run-off d. Surface area lacking e. Modification of char. landscape f. Loss of wildlife habitat, harassment	5	2	5	a. Locate on steeper slope b. Locate on stable ground c. Reinforce drainage dispersion pts. d. Massive excavation e. Specialized design f. Limit number; I & E Program	a. Decrease in density, incr. in cost b. -- c. -- d. Neg. veg. impact; mass movement & waste disposal e. Decrease in density f. Reduction of recreation base; some harassment will persist
Drainfields	a. Excessive slopes b. Modification of char. landscape	5	1	5	a. Sew. collection system b. Limit clearing and size	a. Disposal site limitation b. Limited capacity
Campgrounds (24-hr. Occup.)	a. Surface area lacking b. Slopes generally in excess of 20% c. Modification of char. landscape d. Loss of wildlife habitat, harassment	4	2	4	a. Massive excavation b. Terraces w/bin walls c. Specialized design d. Limit number of visitors, I&E Pro.	a. Neg. vis. imp; mass mvmnt. & waste dis. b. Neg. vis. impact, decr. in density c. Increased area, limited density d. Reduction of rec. base; some harassment will persist
Human Occup. (Day Use)	a. Surface area lacking b. Slopes generally in excess of 20% c. Modification of char. landscape d. Loss of wildlife habitat, harassment	4	2	4	a. Massive excavation b. Terraces w/bin walls c. Specialized design d. Limit number of visitors, I&E Pro.	a. Neg. vis. imp; mass mvmnt. & waste dis. b. Neg. vis. impact, decr. in density c. Increased area, limited density d. Reduc. of rec. base, some harassment will persist
Human Occup. (Ped. Access)	a. Vegetation is natural barrier b. Steep side slopes c. Wildlife harassment	3	1	1	a. Provide reinforced & drained trails b. Maintain low gradients c. I & E Program	a. Visual impact b. Potential visual impact c. Some harassment will persist

Mountain Front, Steep Side Slope, Transition Forest Clear Cut (MSS/TFC)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Vegetation is natural barrier b. Steep side slope c. Wildlife harassment	3	1	1	a. Provide reinforced & drained trails b. Maintain low gradients c. Restrict to trails; I & E Program	a. Visual impact b. Potential visual impact c. Some harassment will persist
Cross-Country Travel (Vehicles)	a. Vegetation is natural barrier b. Steep side slopes c. Wildlife harassment	4	1	4	a. Provide reinforced & drained trail (see road construc.) b. Maintain low gradients c. Restrict to trails; I & E Prog.	a. Source of surface run-off b. " " " " c. Some harassment will persist
Buildings (Contin. Found.)	a. Steep slopes - visual impact	4		4	a. Custom planning	a. --
Buildings (Pole Found.)	a. Steep slopes - visual impact	3		5	a. Custom planning	a.
Powerline Tower Install.	a. Quantity of clearing swath required b. Modification of char. landscape c. Loss of wildlife habitat and harassment	3	2	5	a. Design to fit landscape b. None c. On site invest., route selection	a. -- b. -- c. Some loss of wildlife habitat
Buried Pipeline Install.	a. Quantity of clearing swath required b. Steep slopes - machinery limitations c. Modification of char. landscape d. Mass movement potential e. Shallow soil f. Loss of wildlife habitat and harassment	4	2	4	a. Design to fit landscape b. Special design c. -- d. None e. Erosion control f. On site invest., route selection	a. -- b. --- c. -- d. -- e. -- f. Some loss of wildlife habitat
Vegetative Stabiliz. (Dunegr.)	a. Undesirable plant composition	5	5	5	a. Restore w/natives or adapt species	a. --

Mountain Front Steep Side Slope, Transition Forest, Second Growth (MSS/TFS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Biological & Visual Tolerance Levels: Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Susceptible to mass movement, backsloped and drainageway fills	4			a. Locate on stable ground; install bin walls	a. Problems will still persist
	b. Road ditch erosion				b. Reinforce ditches & dispersion points, outslope road	b. Erosion of fill slope
	c. Steep slopes requiring extensive excavation				c. Minimal road widths	c. Safety hazard (traffic)
	d. Modification of char. landscape			4	d. Careful location, minimal width, cut and fill	d. Limited traffic volume
	e. Loss of wildlife habitat		2		e. Limit number of visitors	e. Reduction of recreation base
Parking Lots	a. Slopes generally in excess of 20%	5			a. Locate on steeper slopes	a. Decrease in density, incr. in cost
	b. Susceptible to mass movement				b. Locate on stable ground	b. --
	c. Surface run-off				c. Reinforce drainage dispersion pts.	c. --
	d. Surface area lacking				d. Massive excavation	d. Neg. veg. impact, mass mvmnt & waste disposal
	e. Modification of char. landscape			5	e. Specialized design	e. Limited density
	f. Loss of wildlife habitat; harassment		2		f. Limit number; I & E Program	f. Reduc. of rec. base; some harassment will persist
Drainfields	a. Excessive slopes	5	1		a. Sew. collection system	a. Disposal site limitations
	b. Not compatible with char. landscape			5	b. Limit size & clearing	b. Limited capacity
Campground (24-hr. Occup.)	a. Surface area lacking	4			a. Massive excavation	a. Neg. vis. imp.; mass mvmnt. and waste disposal
	b. Slopes generally in excess of 20%				b. Terraces w/bin walls	b. Neg. vis. imp.; decr. in density
	c. Modification of char. landscape			4	c. Specialized design	c. Decr. in density, incr. in cost
	d. Loss of wildlife habitat; harassment		2		d. Limit no. of visitors, I&E Program	d. Reduction of rec. base; some harassment will persist
Human Occup. (Day Use)	a. Surface area lacking	4			a. Massive excavation	a. Neg. vis. imp.; mass mvmnt. & waste disposal
	b. Slopes generally in excess of 20%				b. Terraces w/bin walls	b. Neg. vis. imp.; decr. in density
	c. Modification of char. landscape			4	c. Specialized design	c. Decr. in density, incr. in cost
	d. Loss of wildlife habitat; harassment		2		d. Limit no. of visitors; I & E Pro.	d. Reduc. of rec. base; some harassment will persist
Human Occup. (Ped. Access)	a. Vegetation is natural barrier	3		1	a. Provide reinforced & drained trails	a. visual impact
	b. Steep side slopes				b. Maintain low gradients	b. Potential visual impact
	c. Wildlife harassment		1		c. I & E Program	c. Some harassment will persist

Mountain Front Steep Side Slope, Transition Forest, Second Growth (MSS/TFS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-Country Travel (Horses)	a. Vegetation is natural barrier b. Steep side slopes c. Wildlife harassment	3	1	1	a. Provide reinforced & drained trails b. Maintain low gradients b. Restrict to trails; I & E Program	a. Visual impact b. Potential visual impact c. Some harassment will persist
Cross-Country Travel (Vehicles)	a. Vegetation is natural barrier b. Steep side slopes c. Visual impact of trailing d. Wildlife harassment	4	1	3	a. Provide reinforced & drained trails (see roads construc.) b. Maintain low gradients c. Admin. control d. Restrict to trails; I & E Program	a. Source of surface run-off b. " " " " c. Creation of roads d. Some harassment will persist
Buildings (Contin. Found.)	a. Steep slopes b. Modification of char. landscape	4		4	a. Custom planning a. Maintain low gradients	a. -- b. --
Buildings (Pole Found.)	a. Steep slopes b. Modification of char. landscape	3		4	a. Design to fit landscape b. Careful location, custom design	a. -- b. --
Powerline Tower Install.	a. Quant. of clearing swath required b. Not compatible with char. landscape c. Loss of wildlife habitat	3	2	4	a. Design to fit landscape, place by helicopter b. Careful location, burial of lines c. On-site invest. - route selection	a. -- b. Visual impact c. Some loss of wildlife habitat
Buried Pipeline Install.	a. Quant. of clearing swath required b. Steep slope - machinery limitation c. Modification of char. landscape d. Mass movement hazard e. Shallow soils f. Loss of wildlife habitat	4	2	3	a. Design to fit landscape b. Special design c. Vary alignment & clearing d. -- e. Erosion control investigation f. On-site vegetation - route select.	a. -- b. -- c. -- d. -- e. -- f. Some loss of wildlife habitat
Vegetative Stabiliz (Dunegrass)	a. Undesirable plant composition	5	2	5	a. Restore w/natives or adapt species	a. --

Mountain Front, Tableland, Transition Forest - Second Growth (MTL/TFS):

Within this delineation are landforms of less than 20-percent slope gradient and include 30-meter terraces along the seaward side, ridgetops broad enough to offer some opportunity for recreation developments and bench lands adjacent to the inland lakes. These features are seldom continuously level or plateau-like and are more commonly uneven with steep pitches, and in some places, wet, seepy areas. They comprise approximately 1.7 percent of the total area.

Transition Forest - Second Growth (MTL/TFS): This stage of the transition forest is found between Highway 101 and the west shore of Siltcoos and Tahkenitch Lakes and also between the east boundary of the N.R.A. and Threemile Lake. The ages of the stands vary from approximately 12 to 50 years since cutting, and the size of the trees ranges from 10-foot saplings to trees 75 feet high. The overstory composition varies from pure stands of sitka spruce, hemlock, or Douglas-fir, to mixtures of all three species with scattered shorepine and western redcedar.

In young stands, the shrub layer is an important component of the forest, but in older stands, the shrub layer is completely shaded out. Rhododendron, salal, evergreen huckleberry, trailing blackberry, sword fern, bracken fern, etc., are the most common shrubs in second-growth forests.

The number and kind of wildlife species inhabiting second-growth transition forests is dependent on the age of the forest. Young second growth (12-25 years) supports a greater number of species than older second growth (26-50 years) because the vegetation is more diverse. The older second growth lacks a shrub layer. The absence of this shrub layer results in a reduction of species, especially birds.

Young second-growth forest is used by 102 species--66 birds, 28 mammals, 5 amphibians and 3 reptiles. The mountain quail, Townsend chipmunk, bobcat and northern alligator lizard are common inhabitants of this forest stage.

Older stages of second-growth forest are inhabited by 70 species--32 birds, 28 mammals and 10 amphibians. The 8 species of salamanders found on the N.R.A. all use this forest stage. Common species found in this forest are the chestnut-backed chickadee, California red-back vole and Olympic salamander.

Since most of these landforms are fairly accessible they have been harvested for their wood products. They support Douglas-fir, western redcedar, hemlock and alder in the disturbed or wetter portions, and an understory of salal, huckleberry and rhododendron.

These sites are generally the most suitable for recreation developments.

View of the Mountain Front, Tablelands (MTL) supporting Transition Forest, second growth (TFS). South end of Siltcoos Lake.

View of second growth overstory on Mountain Front Tableland. Early stages of second growth (12-25 years) support high populations of wildlife species; older stages (25 years and older) may have the same number of species but fewer individuals.

Mountain Front Table Land, Transition Forest, Second Growth (MTL/TFS)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis.	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. Occ. wet areas b. Modification of char. landscape (slight) c. Loss of wildlife habitat	1	2	2	a. Drain and/or land fill b. Visual analysis before planning c. Limit number of visitors	a. -- b. -- c. Reduction of recreation base
Parking Lots	a. Occ. wet areas b. Modification of char. landscape (slight) c. Loss of wildlife habitat and harassment	1	2	2	a. Drain and/or landfill b. Visual analysis before planning c. Limit no. of visitors; I & E Pro.	a. -- b. -- c. Reduction of recreation base; some harassment will persist
Drainfields	a. On-site invest. needed b. Areal extent may be limiting c. Modification of char. landscape	3	1	3	a. -- b. -- c. Limit clearing size	a. -- b. -- c. Limited efficiency
Campgrounds (24-hr. Occup.)	a. Occ. wet areas b. Slight modification of char. landscape c. Loss of wildlife habitat and harassment	1	2	2	a. Drain and/or land fill b. Careful design c. Limit number of visitors	a. Slight visual impact b. - - c. Reduction of recreation base, some harassment will persist
Human Occup. (Day Use)	a. Occ. wet areas b. Slight modification of char. landscape c. Loss of wildlife habitat and harassment	1	2	2	a. Drain and/or land fill b. Careful design c. Limit unumber of visitors, I&E Pro.	a. Slight visual impact b. - - c. Reduction of recreation base; some harassment will persist
Human Occ. (Ped. Acces)	a. Vegetation is natural barrier in some areas b. Wildlife harassment	1	1	1	a. Provide reinforced trails b. I & E Program	a. -- b. Some harassment will persist

Mountain Front Table Land, Transition Forest, Second Growth

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels		Some Alternatives or Treatments	Possible Negative Results
			Biol.	Vis		
Cross-Country Travel (Horses)	a. Vegetation is natural barrier b. Wildlife harassment	2	1	1	a. Provide reinforced trails b. Restrict to trails; I & E Program	a. -- b. Some harassment will persist
Cross-Country Travel (Vehicles)	a. Vegetation is natural barrier b. Wildlife harassment	4	1	2	a. Provide drained & reinforced trails b. Restrict to trails; I & E Program	a. -- b. Some harassment will persist
Buildings (Contin. Found.)	a. Occ. wet areas b. Slight modification of char. landscape	1		2	a. Drain and/or landfill b. Siting & custom design	a. --
Buildings (Pole Found.)	a. Slight modification of char. landscape	1		2	a. Careful siting and custom design	a. --
Powerline Tower Install.	a. Some areas may not be compatible w/char. lands. b. Erosion hazard on steeper portions c. Loss of wildlife habitat	1	2	3	a. Visual analysis & careful planning b. Water bars and seedings c. On-site investigation; route selection	a. -- b. -- c. Some loss of wildlife habitat
Buried Pipeline Install.	a. Slight modification of char. landscape b. Loss of wildlife habitat	1	2	2	a. Vary alignment & clearing required b. On-site invest; route selection	a. b. Some loss of wildlife habitat
Vegetative Stabiliz. (Dunegrass)	a. Undesirable plant composition b. Shading & plant compet.	5	5	5	a. Restore w/natives or adapt species	a. --

Marsh ( ): This feature generally occurs within the deflation plain, and during the late winter has a shallow covering of standing water. Marshes comprise approximately .97 percent of the total area.

The plants of the marsh community are adapted to grow in wet habitats which range from continuous flooding to periodic submergence. Fluctuations of the water table level between wet and dry seasons will keep fresh-water marshes flooded most of the year. The deflation plain marsh is open, having standing water most of the year. The marsh is usually associated with a shorepine forest with the pines growing around the periphery. Coast willow grows with the pines along the edges, or is found scattered throughout. Other species associated with this marsh type are: slough sedge, water lily, pond weed, cattail, bulrush, etc.

Marshes are critical habitats used by 85 species of wildlife--61 birds, 17 mammals, 5 amphibians and 2 reptiles. This habitat receives heavy use by 49 species of waterfowl, shorebirds and wading birds. Waterfowl and shorebirds are most abundant from September to May. Aquatic mammals, beaver, otter and muskrat, are very common in this habitat.

These areas, due to the standing water levels, do not invite visitor use, except for those interested in viewing wildlife, particularly waterfowl and other aquatic birds. Opportunities for observation platforms to view the wildlife could be afforded in certain areas.

The major consideration in the management of these areas is their value as wildlife habitat.

View of marshlands in the south end of the dunes sheet.

View of willow, sedge and shorepine species along fringe of marsh. Marshes are critical habitats for 49 species of waterfowl, shore-wading birds and 3 species of aquatic mammals.

Marsh (W)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Road Construction	a. High water table (annual consideration) b. Not compatible with characteristic landscape c. Loss of critical wildlife habitat; harassment	4	5	5	a. Land fill b. None compatible with charac. landscape c. None	a. Loss of critical wildlife habitat; harassment; neg. visual impact b. -- c. --
Parking Lots	a. High water table (annual consideration) b. Not compatible with charac. landscape c. Loss of critical wildlife habitat & harassment	4	5	5	a. Land fill b. None c. None	a. Loss of critical wildlife habitat harassment; neg. visual impact b. -- c. --
Drain-fields	a. High water table (annual consideration) b. Loss of critical wildlife habitat c. Major modification of charac. landscape	5	5	5	a. Land fill b. None c. None	a. Loss of critical habitat; neg. visual impact b. None c. None
Camp-grounds (24-hr. occup.)	a. High water table (annual consideration) b. Not compatible with charac. landscape c. Loss of critical wildlife habitat & harassment	5	5	5	a. Land fill b. None c. None	a. Loss of critical wildlife habitat; harassment; neg. visual impacts b. None c. None
Human Occupancy (Day use)	a. High water table (annual consideration) b. Visual impact c. Loss of critical wildlife habitat; harassment d. Mosquito habitat	5	5	5	a. Land fill b. None c. None d. Biological control	a. Loss of critical wildlife habitat; harassment; neg. visual impact b. -- c. -- d. --
Human Occupancy (Ped. access)	a. High water table (annual consideration) b. Critical wildlife habitat; harassment c. Mosquito habitat d. Visual modification	5	3	3	a. Boardwalk, bridging b. I&E Program c. Biological control d. --	a. Loss of wildlife habitat; harassment; negative visual impacts b. Some harassment will persist c. -- d. --

Marsh (W)

Facility or Activity	Considerations and Limitations	Physical Suitability Rating	Biological & Visual Tolerance Levels: Biol.	Vis	Some Alternatives or Treatments	Possible Negative Results
Cross-country Travel (horses)	a. High water table (annual consideration) b. Critical wildlife habitat; harassment c. Mosquito habitat	5	5	3	a. Boardwalk, bridging b. I&E Program c. Biological control	a. Some loss of critical wildlife habitat; neg. visual impact b. -- c. --
Cross-country Travel (vehicles)	a. High water table (annual consideration) b. Critical wildlife habitat; harassment c. Mosquito habitat d. Visual incompatibility of trailing effect	5	5	3	a. Turnpike trails b. I&E Program c. Biological control d. None	a. Loss of critical wildlife habitat; neg. visual impact b. -- c. -- d. --
Buildings (Contin. found.)	a. High water table (annual consideration) b. Not compatible with charac. landscape c. Loss of critical wildlife habitat	5	5	4	a. Land fill b. None c. None	a. Loss of critical wildlife habitat; neg. visual impact b. -- c. --
Buildings (Pole found.)	a. Not compatible with charac. landscape b. Loss of critical wildlife habitat c. Opportunity for viewing wildlife	3	5	4.	a. None b. None c. --	a. -- b. -- c. --
Powerline Tower Install.	a. High water table (annual consideration) b. Not compatible with charac. landscape c. Loss of critical wildlife habitat	2	5	5	a. Land fill b. None c. None	a. Loss of critical wildlife habitat; neg. visual impact b. -- c. --
Buried Pipeline Install.	a. High water table (annual consideration) b. Loss of critical habitat c. Modification of landscape - temporary	2	5	1	a. Corrosion-resistant pipe b. None c. --	a. -- b. -- c. --
Vegetative Stabiliz. (Dunegrass)	a. High water table (annual consideration)	5		5	a. None	a. --

Lakes and Ponds: These areas have been delineated on the maps by name or symbol where large enough to adequately identify. They include nearly all lakes and ponds within the N.R.A. boundary and comprise approximately 2.87 percent of the total area. Within this category are lakes in the deflation plain, as well as those in troughs adjacent to the mountain front. In several area, particularly the troughs, sand movement from precipitation ridges is filling or "pinching-out" the lakes. In shallow areas of the lakes, vegetation is encroaching upon the lakes and changing them into marshes. In some areas the distinction between lakes and marshes is difficult to make. Most of the lakes are subject to great fluctuations in surface area and depth.

Lakes, ponds and the strips of vegetation surrounding them are very important wildlife habitats. The number and kinds of wildlife using a lake or pond is dependent on many factors--size, depth, connection with streams, and location are just a few of these factors. Wildlife from the surrounding habitats concentrate their activities near lakes and ponds. These strips of vegetation are also used for nesting, feeding and shelter by many of the species frequenting the lakes or ponds.

Lakes and ponds are used or inhabited by 86 species of wildlife--23 fish, 52 birds, 3 mammals, and 8 amphibians. These lakes and ponds are very important to 49 species of waterfowl, shorebirds and wading birds. The osprey fishes in the larger lakes and nests in the snags of adjacent forests. Beaver, muskrat and others are also common residents or users of the larger lakes. The red-legged frog, pacific treefrog, and bullfrog are common residents of most lakes and ponds.

These landscape forms appear to be completely out of context with the dunal landscape. The lakes often appear as surprises to the visitor and as such do not always attract the first-time visitor. However, the returning visitor tends to seek out the lakes, drawn by the settings, incongruity of the scene and abundant wildlife. Once discovered, the lakes cause visitors to tarry and search out the shorelines.

View of Sand Point Lake. These lakes provide nesting, feeding, and resting opportunities for resident, migratory, and wintering populations of waterfowl.

Carter Lake. This is a typical lake occupying a trough adjacent to the Precipitation Ridge stabilized (PRS).

Beach: This geomorphic feature includes the shoreline between the foredune and the ocean. It is a dynamic landscape and capable of supporting many activities. There are approximately 36 miles of beach on the N.R.A.

The beach is used by 35 species--26 birds and 9 mammals. All but six of the birds are shorebirds. Invertebrate organisms are very abundant in the tidal zone of the beach. These organisms are the food source which attracts thousands of shorebirds. In addition, the ocean washes up fish and other animals on which many birds, especially gulls, feed.

The snowy plover, a rare shorebird in Oregon, is dependent on the driftwood tangle adjacent to the foredune and the sandpits (parts of the beach) at the mouths of Siltcoos, Tahkenitch and Tenmile Creek for nesting sites. For the snowy plover these areas are very critical during the nesting season, April through June.

During winter or fall and spring when wintering and migrant shorebirds are present, it is not uncommon to see several thousand birds per mile of beach. From June to August the beach is relatively barren, few species or numbers of birds being present.

Western gull, California gull, mew gull, sanderling and the western sandpiper are a few of the shorebirds commonly present on the beach depending on the season. Deer mice and California ground squirrels frequent the driftwood tangle. The raccoon and bald eagle occasionally scavange fish along the beach. Crows can commonly be seen feeding among the beach drift.

This landscape feature appears to have constant motion on and adjacent to it; waves, bird life, blowing sands, and the flotsam and drift that appears, disappears, or changes location. This creates an ephemeral atmosphere that appears to have an hypnotic effect upon people. The beach becomes an objective that people are constantly striving to reach. It contains excitement, smell, noise, opportunity for solitude, socializing, and discovery.

Some of the factors important to the management of the beach are: (1) its inherent physical tolerance to man's use, (2) the critical nesting area for the snowy plover, and (3) the opportunities it provides for shorebird observations, especially during winter, fall and spring, and the occasional sighting of marine mammals, particularly whales and seals.

View of the Beach with the Foredune (FD) in the background. Twenty species of shore birds use the beach. It is not uncommon to see several thousand shore birds per mile of beach during winter and the fall or spring migrations.

Rivers and Streams: These areas have been delineated on the maps and named where possible. They include all perennial waterways that carry the runoff waters within the N.R.A. boundary. These waterways range in size from the broad Umpqua River to the shallow, 2- to 3-foot wide streams occupying the narrow drainageways of the mountain front. Portions of these waterways are tidal (estuaries). The estuaries of the Umpqua and Siuslaw River extend beyond the N.R.A. boundary. The approximate boundary of tidal influence for Tenmile Creek, Tahkenitch Creek and the Siltcoos River is Highway 101. Threemile Creek is subject to tidal influence for several hundred yards.

The estuaries, their tidal flats (active flood plains), salt marshes, salt meadows and riparian vegetation are an integral unit. This unit is extremely critical to many species of wildlife.

Estuaries are the most fertile naturally occurring areas in the world. This fertility is a result of the nutrients and organic matter produced by decaying vegetation of the salt marshes and meadows, washed down by the stream, and brought in by tidal action. These nutrients and organic matter stimulate the growth of plankton and invertebrate organisms. Organic matter, plankton and invertebrate organisms are the basic food sources within the estuary. These food sources attract many wildlife species.

Estuaries and the tidal flats are frequented by 166 species--70 fish, 88 birds and 8 mammals. Ocean and bay fish use the estuaries for spawning, feeding, and as nurseries. All but 7 of the 88 birds frequenting the estuaries are shorebirds, wading birds, waterfowl, or oceanic birds. Shorebirds feed on the invertebrate organisms of the tidal flats. Waterfowl, wading birds and oceanic birds concentrate their feeding activities on the fish, invertebrates and plant life. From September through May thousands of wintering or migrant shorebirds and waterfowl use the estuaries. The osprey and bald eagle, rare and endangered species, also fish in the estuaries. The sandspits adjacent to the river mouths are nesting sites for the rare snowy plover.

Salt marshes and meadows, integral parts of the estuaries, are used by 77 species--66 birds, 8 mammals, 2 amphibians and 1 reptile. Many of the birds which frequent the estuary also use the salt marshes and meadows for shelter, feeding and nesting. In addition, many terrestrial species from the habitats through which the estuaries pass concentrate their activities in the vicinity of the streams.

Species commonly found in estuaries and tidal flats, depending on the season are: the surf scoter, widgeon duck, pintail duck, California gull, sanderling, double-crested cormorant, great blue heron, dunlin, western sandpiper and harbor seal.

Streams of the narrow mountain drainageways (Deer Creek), those flowing parallel to the base of the mountain front (Saunder Creek) and the freshwater portions of streams entering the ocean (Tahkenitch Creek) and their riparian vegetation are critical wildlife habitats.

These streams are inhabited by 46 species--12 fish, 23 birds, 3 mammals and 8 amphibians. Anadromous and resident salmonoids use these streams as

migration routes, spawning and rearing areas. These streams are important breeding areas for many amphibians. Waterfowl and wading birds (19 species) commonly feed in the larger streams.

The riparian vegetation is used by 74 species--46 birds, 15 mammals, 12 amphibians, and 1 reptile. These species show a decided preference for streamside vegetation. Many of these are the same species that inhabit the streams. In addition, many species from the habitats through which the streams pass concentrate their activities near the stream.

Common species inhabiting the streams are: wood ducks, great blue herons, beaver, muskrat, cutthroat trout, and blacksided dace. Mink, pacific jumping mice, Trowlridge and Pacific shrews, myrtle warblers, Traill's fly-catchers, pacific giant and olympic salamanders show a decided preference for streamside vegetation. The white-footed vole, one of the rarest mammals in North America, lives in the riparian areas.

These features tend to segment the dunal area. As such, the streams and rivers become quasi boundaries for both island and beach traveling. Directions to newcomers are given as so many miles north or south of such and such creek (river).

The rivers and streams as such may attract use, but more often orient use to certain segments.

The factors important to the management of these units are: (1) their extreme importance to many species of wildlife including the rare or endangered slowy plover, bald eagle, osprey and white-footed vole, and (2) their great recreational potential for viewing wildlife, especially aquatic birds.

View of the Siltcoos River; this portion is subject to tidal influence. The river and the adjacent vegetation are critical wildlife habitats for many species.

Stabilization Plantation (Plant): These man-made plant communities were established to slow down or stop the migration of dunes, in order to protect rivers, lakes, forests, roads, buildings, campgrounds, etc., or any real estate threatened by moving sand.

Three plant species are used in sand stabilization plantations: European beachgrass, Scotch broom, and shorepine. Two-year-old nursery stock beachgrass is planted first on the open sand, usually in grids 18 by 18 inches. A year later, after the beachgrass roots and offers some protection and cover, one-year-old scotch broom seedlings are planted in 6x6 or 8x8 foot grids. Concurrently with the scotch broom or a year later, two-year-old shorepine seedlings are planted on the same grid spacing.

The artificial establishment of stabilization plantations is based on ecological principles of plant succession. European beachgrass, as the pioneer species, provides the first binding force of the moving sand, and also provides needed cover and protection for the less hearty scotch broom and shorepine. Beachgrass does not do well without a continuous supply of sand, and has to be fertilized during its early years of growth. Scotch broom, once established, however, fixes nitrogen in the soil, nourishing the beachgrass, and also provides physical protection for the slower growing shorepine. With time, the shorepine eventually becomes dominant and starts to shade out the scotch broom and beachgrass. Some 10- to 15-year-old plantations in the Siltcoos area appear to be doing quite well, with the pines attaining heights of 10 to 12 feet, but most plantations within the NRA are too young to assess their eventual fate. In one of the oldest plantations south of the Siuslaw River (the first plantings in this area were done in 1949), the shorepine has become the overstory dominant, but grows stunted. The scotch broom survives as 6-foot shrubs with massive stems, the beachgrass is very sparse, and the ground is mostly bare sand. The greater wind exposure of this area is thought to be a problem with the establishment of this plantation. The ground cover of this community ranges from 60 to 80 percent in some 2- to 5-year-old plantations, to almost none in 20-year-old plantations where the ground is just about totally devoid of understory vegetation.

The number and kinds of wildlife species using a plantation is dependent on its age, plant species composition, and location. Pure beachgrass plantations are generally used by very few species of wildlife. Older plantations containing beachgrass, 6-foot-tall scotch broom, and 12-foot-tall shorepine may be used by 52 wildlife species.

Some of the factors important to management are: (1) these areas are not appealing to human use, (2) most plantations are not in keeping with the natural landscape, (3) they are significant modifiers of the natural processes, (4) there is a need to study the beachgrass to determine its rate of spread, invasion ability into natural vegetation, longevity, and its site-growing parameters, (5) alternatives to plantations such as dredging, scooping, and/or respect of the wind movement processes should be considered, and (6) tree species in many of the plantations are offsite and are susceptible to disease and insect problems.

View of Plantations of various ages in the vicinity of Siltcoos River outlet.

Plantation of beachgrass, scotch broom and shorepine.

DISCUSSION AND CONCLUSIONS

The vegetation growing on the sand dunes is a reflection of sand movement, climate, fires, and the activities of man. Sand dune formation and their continuous migration have destroyed vegetation in their path. The low moist areas in the wake of sand dunes have provided ideal sprouting sites for seeds of all kinds and those that survived have undergone plant succession, which in turn awaited burial by the next dune. More specialized plants have been able to colonize moving sand and have vegetated and stopped or slowed the migration of dunes. These colonized dunes then have undergone plant succession which, in many cases, has led to forest types. In the deflation plain, the fluctuating water table from wet season to dry season (3 to 5 feet above the ground surface) favors plants that can survive periodically under water or in close proximity to the water table. Here, as on the stabilized dunes, plant succession is leading to a shorepine forest. Where the deflation plain started forming in the last 50 to 60 years, the plants growing on it now are at advanced successional stages like shrub thickets and forests, as in "Goose Pasture" and vicinity. Mature shorepine forests are found in the older deflation plain of the area between Beale and Horsfall Lakes. Where the deflation plain started forming in the last 10 to 15 years, as along the south spit of the Siuslaw River, pioneer species of grasses, rushes, and sedges form the dominant plant communities. In the deflation plain, plant succession is very rapid, going from herbaceous communities, to shrubs, to shorepine forests. Important factors in the management of the deflation plains is the value these areas have as wildlife habitats and the opportunities they provide for studying the principles of plant succession.

Climate has played an important part in the establishment of vegetation on open sand. Rainfall and seasonal winds affect the establishment and survival of vegetation on the dunes' surface. Most species depend on the high rainfall (average 65 inches annually) for their survival. Seasonal winds blow the sand that forms and shapes the dunes. Before introduction of European beachgrass and the formation of the foredune, wind blew fresh sand off the beaches and carried it inland to deposit it on the big dunes. This primary supply of sand replenished the one being lost to vegetation colonization and to the eastward migration of the dunes. Formation of the foredune with its vegetative cover of beachgrass very effectively cut off the primary sand supply. Wind erosion of the dune surface behind the foredune created a secondary sand supply for the replenishment of the big dunes, eroding the surface down to the water table, forming the deflation plain. The secondary sand supply is still being utilized as the deflation plain slowly migrates east, possibly to span across the open sand.

Fire has undoubtedly played a part in the maintenance or disappearance of plant communities growing on the sand dunes. Old, scattered fire-scarred trees survived through fires that killed or set back everything else. In most cases, plant succession following a fire regenerated the forests.

Man has drastically changed the picture and the vegetation of the National Recreation Area, largely reflecting his activities on the landscape. Introduced plant species helped create the foredune and deflation plain, vegetating what once was open sand. The planting of stabilization and wildlife

plantations have added to the area of vegetated dune surface. Finally, the elimination of fire as a natural phenomenon in plant succession precludes the destruction of forests that would have been set back and invaded by moving sand. The present trend of sand being rapidly colonized by vegetation points out the possibility of seeing most of the open dunes stabilized within a person's lifetime.

Within the Oregon Dunal Area, the lands providing the greatest opportunities of activities as well as the major visual attractions are found in the open sand areas. It should be noted that only one-third of the total NRA land base is open sand. This is further reduced to less than one-fourth of the area during the winter months when the climate-activated ground water floods many expanses.

With the increasing potential of changes in the leisure time patterns, we should be basing our planning philosophies on the winter land base.

To follow the intent of the NRA Bill, the amount of open sand area must be determined and then managed at that amount. Hopefully, this will be at least the percent of area now present or an increase.

To manage open sand, we have many methods available. But, basically, it will mean retarding the encroachment of vegetation or breeching of the foredune to maintain a fresh supply of sand. It is feared by many that if the foredune is <u>not</u> breeched, the Oregon Dunes have a limited life. This fear or theory has sound facts and theorum behind it. To manage the Dunes to the intent of the Act, a thorough understanding of the foredune and its creator, European beachgrass, and their impact upon the dunal process must be made.

Future programs involving introduction of plant species, especially plantations, should consider all foreseeable alternatives to the action and include full public involvement.

The lands within the boundary provide an extraordinary variety of habitat for a host of wildlife species. No place in Oregon has a wider variety of species within a comparably short distance than is found here. The protection and maintenance of these creatures and their habitat types is of utmost importance.

The greatest problems in the management of these lands, from a resource value point of view, will be:

(1) To resolve the conflict between creating desired recreational developments and the retention of the critical wildlife habitats, since riparian and stabilized dune features are some of the most suitable landforms for development, yet they are the most critical wildlife areas.

(2) The preservation of the open sand areas and to hold the natural vegetation advancement in check, particularly the deflation plain process.

(3) The preservation of the open sand areas and natural processes while providing protection to man-made facilities, properties and lakes.

(4) To overcome the problem of sanitation in an area of high precipitation and fluctuating water tables.

Summary of Acreages and Percentages of Total Area
(within the N.R.A. Boundary)

Map Symbol	Percent of total within N.R.A. Boundary	Approx. acreage
FD	1.55	485
HWS	4.51	1410
HW	8.58	2680
HA	3.48	1090
Deflation Plain Combined:	17.08	5350
TW	10.35	3235
TDA	9.24	2885
OA	10.18	3200
PA	1.72	540
DS (All)	8.91	2785
DSA (All)	1.64	520
PRS (All)	.39	125
PRA	1.77	555
PRX	.90	285
SC	.09	30
RS	.68	215
FA (All)	.66	210
FS (All)	.41	135
MSM	.31	100
MMV	.33	105
MDW	.33	105
MSS (All)	11.79	3690

Summary of Acreages and Percentages of Total Area
(Within the N.R.A. Boundary)

Map Symbol	Percent of total within N.R.A. Boundary	Approx. Acreage
MTL	1.20	380
Marsh	.97	310
Lakes	2.87	900
Plantations	.06	1,230
Total		32,555

17.1% of the total area has been scoured to the deflation plain

4.5% of the total area is in lakes, streams, and marshes

34.16% of the total area is open sand in the summer

23.86% of the total area is open sand in the winter (due to rise in water table)

18.89% of the total area is partially vegetated and open in the summer

10.31% of the total area is partially vegetated and open in the winter (due to rise in the water table)

11.35% of the total area is on older, naturally stabilized dunal features

14.46% of the total area is lands within the mountain front

41.89% of the total area is strongly affected by high water tables

5.19% of the total area is partially affected by high water tables

53.42% of the total area is slightly to not affected by high water tables

1.70% of the total area is rated physically suit. 1 for campgrounds

8.91% of the total area is rated physically suit. 2 for campgrounds

9.02% of the total area is rated physically suit. 3 for campgrounds

1.70% of the total area is rated physically suit. 1 for day use

8.91% of the total area is rated physically suit. 2 for day use

19.15% of the total area is rated physically suit. 3 for day use

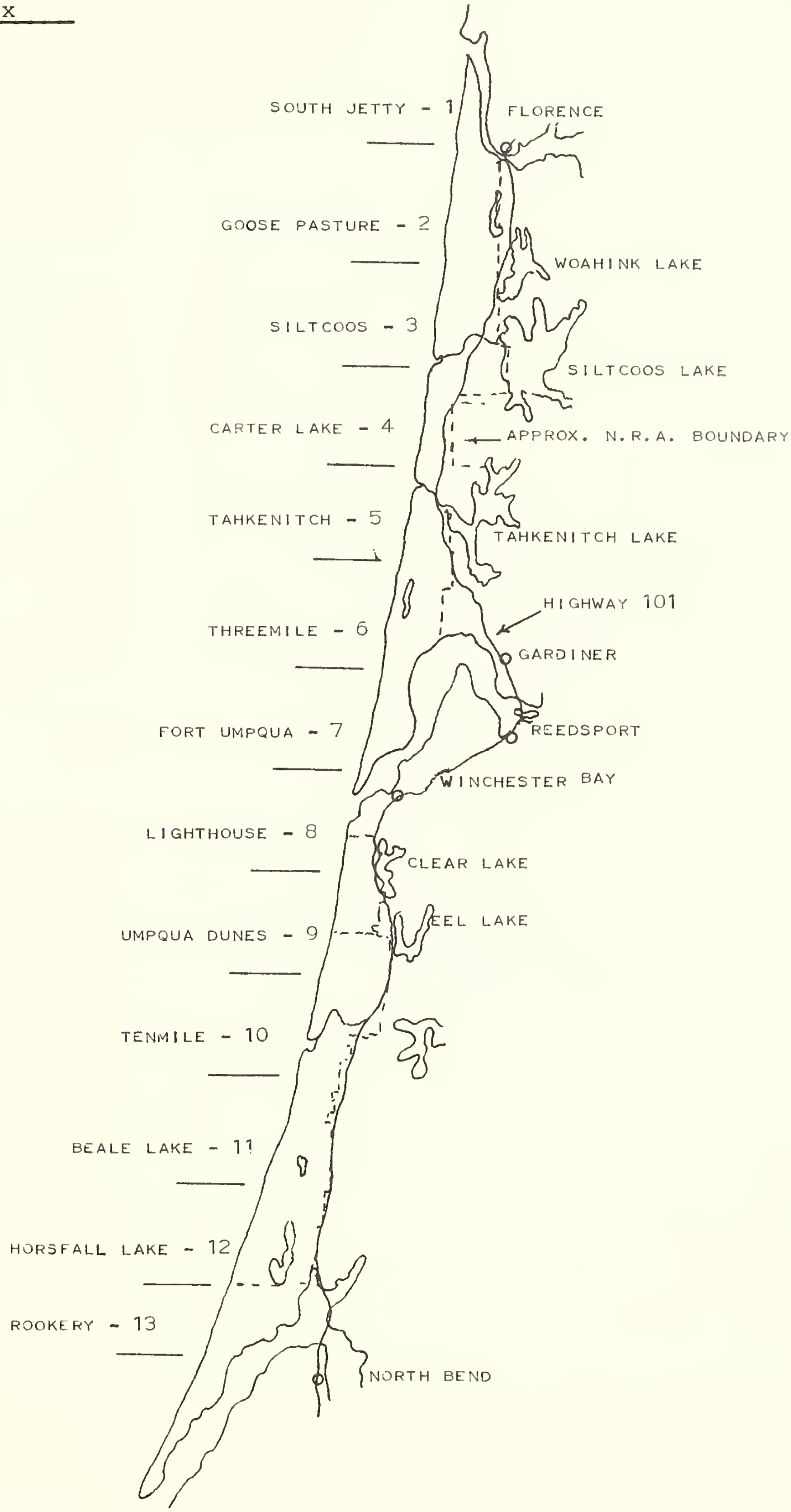
Mapping Units in Various Groupings
Percent of Total Area

Deflation Plain		Water		Summer Open Sand		Winter Open Sand
DG		Marshes	.97	PRA	1.77	1.77
DGL		Lakes	2.87	PRX	.90	.90
DT		FA	.66	TDA	9.24	9.24
DST				OA	10.18	10.18
	17.08		4.50	PA	1.72	1.72
				TW	10.35	--
					34.16	23.81

Summer Partially Vegetated and Open		Winter Partially Veg. & Open	Stabilized Older Surfaces	
HA	3.48	3.48	DS	8.91
HW	8.58	--	DSA	1.64
RS	.68	.68	PRS	.39
SC	.09	.09	FS	.41
FD	1.55	1.55		
HWS	4.51	4.51		
	18.89	10.31		11.35

Water Table Affected land areas		Partially Affected land areas		Seasonally Dry land areas			
Defl. Plain	17.08	HWS	4.51	MSS	11.79	PA	1.72
Marsh	.97	RS	.68	MTL	1.70	HA	3.48
FA	.66			PRA	1.77	SC	.09
TW	10.35			PRX	.90	FD	1.55
HW	8.58			TDA	9.24	DS	8.91
FS	.41			OA	10.24	DSA	1.64
MSM	.31			PA	1.72	PRS	.39
MMV	.33						
MDW	.33						
	39.02		5.51				53.42

Photomosaic Index



PHOTOMOSAIC INDEX

SOUTH JETTY - 1

GOOSE PASTURE - 2

SILTCOOS - 3

CARTER LAKE - 4

TAHKENITCH - 5

THREEMILE - 8

FORT UMPQUA - 7

LIGHTHOUSE - 8

UMPOUA DUNES - 9

TENMILE - 10

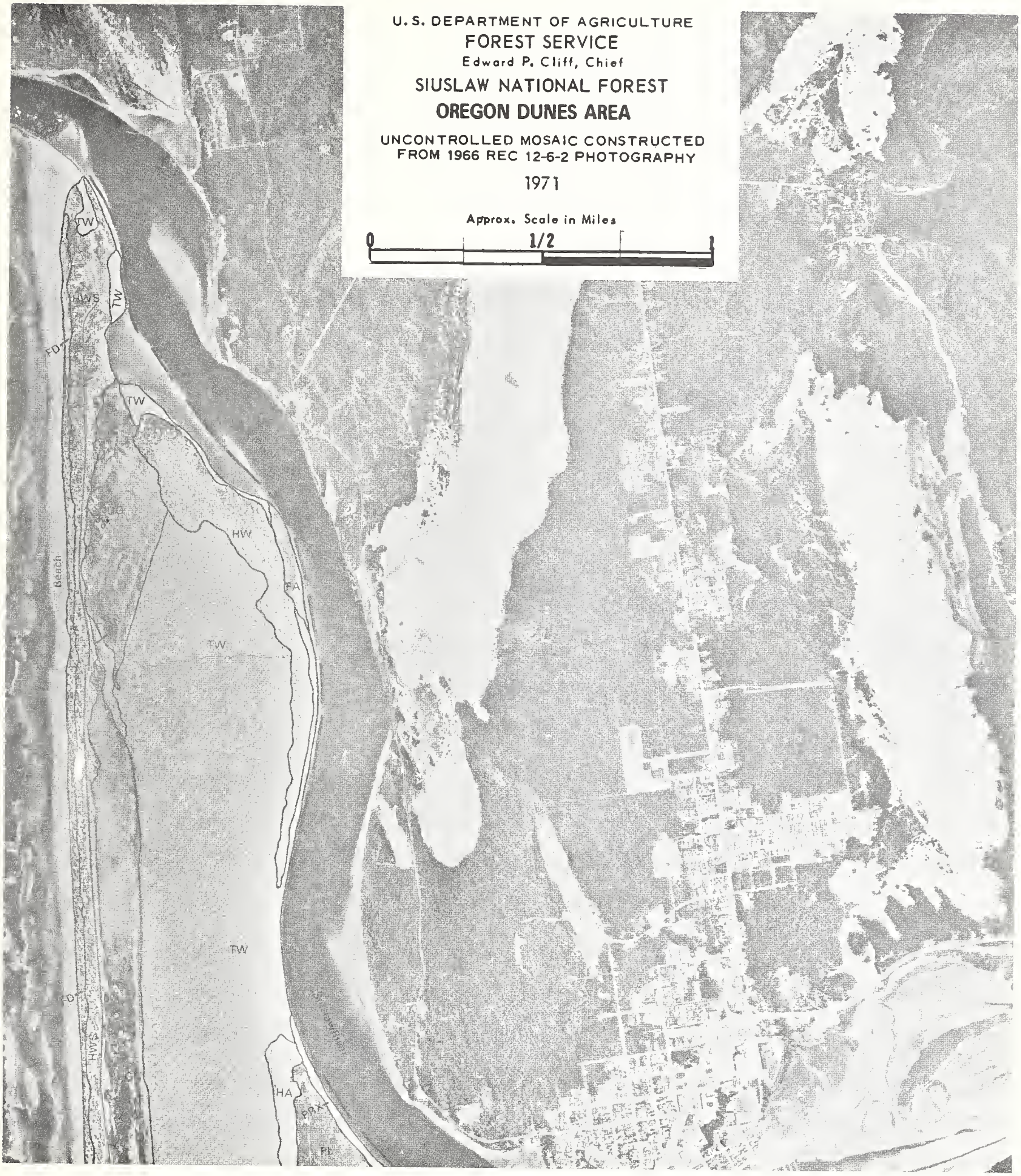
BEALE LAKE - 11

HORSFALL LAKE - 12

ROOKERY - 13

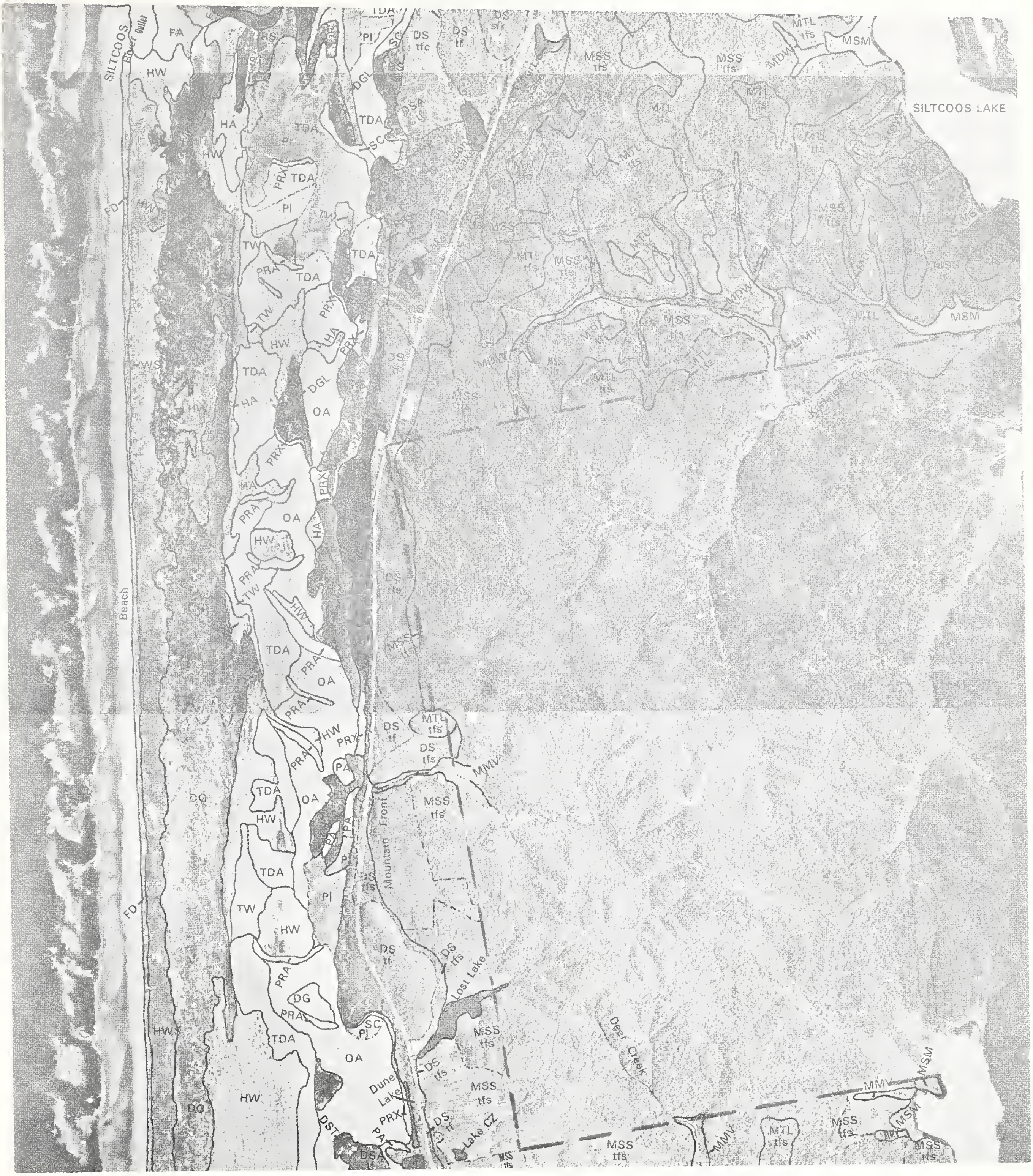
MAPPING UNIT LEGEND

MAP SYMBOL	DESCRIPTION
FD	Foredune
HWS	Hummocks, Occ. Wet, Stabilized
HW	Hummocks, Occ. Wet
HA	Hummocks, Dry
DG	Deflation Plain; grasses, rushes and sedges
DGL	Deflation Plain; low shrubs
DT	Deflation Plain; tall shrub thicket
DST	Deflation Plain; shorepine forest
TW	Transverse Ridge, Occ. Wet
TDA	Transverse Ridge, Dry
OA	Oblique Ridge System
PA	Parabola, Active
DS/TF	Stabilized Dune Surface; transition forest
DS/TFO	Stabilized Dune Surface; transition forest, old growth
DS/TFC	Stabilized Dune Surface; transition forest, clearcut, 2–12 years
DS/TFS	Stabilized Dune Surface; transition forest, second growth, 12–50 years
DS/SFR	Stabilized Dune Surface; shorepine forest of stabilized dunes
DSA/TF	Stabilized Dune Surface; Eroding; transition forest
DSA/TFS	Stabilized Dune Surface, Eroding; transition forest, second growth
DSA/SFR	Stabilized Dune Surface, Eroding; shorepine forest of stabilized dunes
PRS/TF	Precipitation Ridge, Slip Face; transition forest
PRS/SFR	Precipitation Ridge, Slip Face; shorepine forest of stabilized dunes
PRA	Precipitation Ridge, Active Slip Face
PRX	Precipitation Ridge, Active Slip Face; threatening
SC	Conditionally Stable Slip Face
RS	Rolling, Partially Stabilized Dune Surface
FA	Flood Plain, Active
FA/SM	Flood Plain, Active; salt marsh — meadow
FS/SFR	Flood Plain, Stabilized; shorepine forest of stabilized dunes
FS/TF	Flood Plain, Stabilized; transition forest
MSM	Mountain Front; shoreline marsh
MMV	Mountain Front; marshy valley fill
MDW	Mountain Front; narrow drainageway
MSS/TF	Mountain Front, Steepside Slope; transition forest
MSS/TFO	Mountain Front, Steepside Slope; transition forest, old growth
MSS/TFC	Mountain Front, Steepside Slope; transition forest, clearcut
MSS/TFS	Mountain Front, Steepside Slope; transition forest, second growth
MTL/TFS	Mountain Front, Tableland; transition forest, second growth
	Marsh
L or Lake	Lakes and Ponds
	Beach
Named	River and Stream Courses
PL	Plantations, with years since planted
	Land use boundary
	Gradation boundary between plant communities
	Approximate N.R.A. boundary
	Mass movement, headwall escarpment

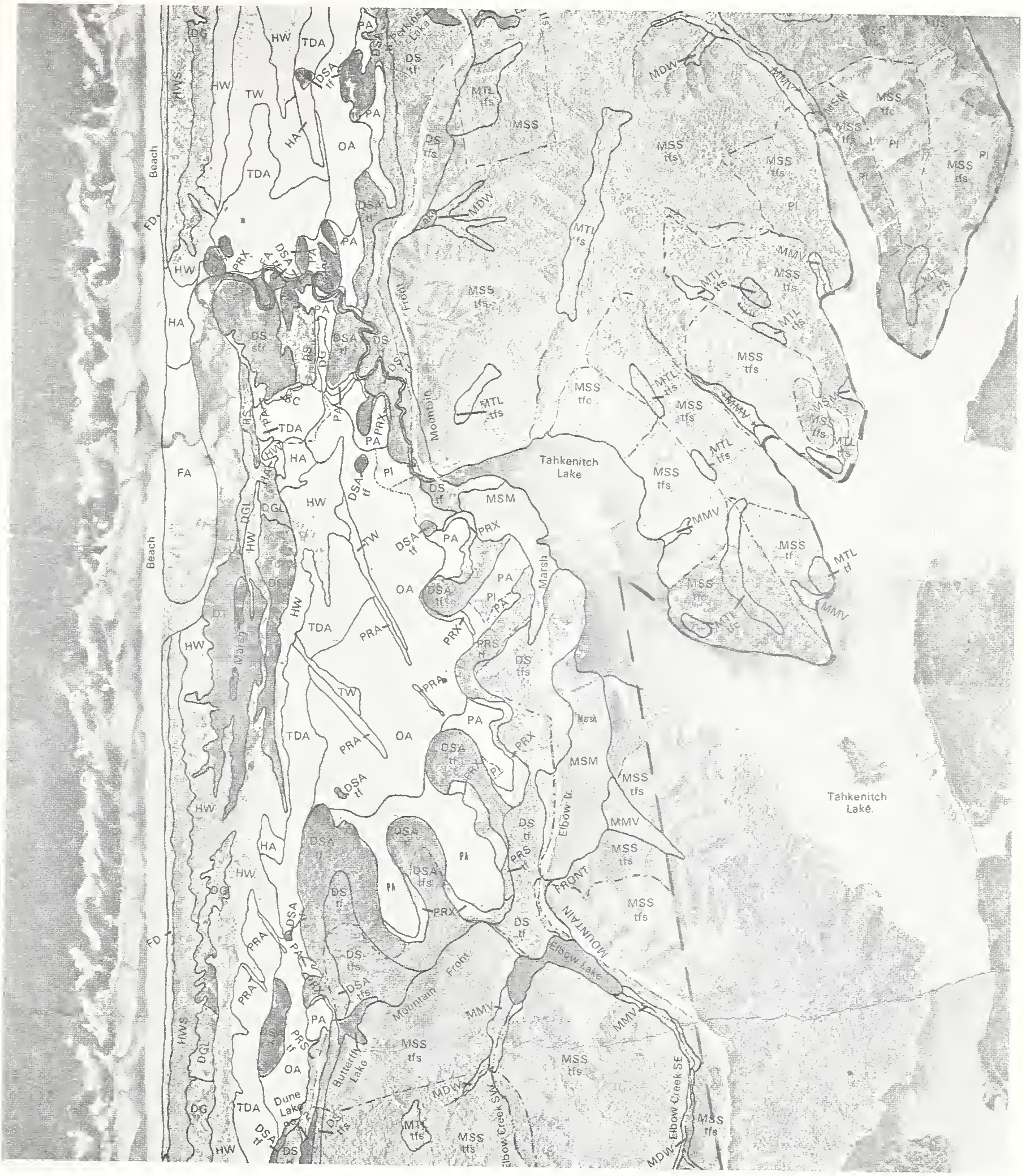

U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Edward P. Cliff, Chief
SIUSLAW NATIONAL FOREST
OREGON DUNES AREA
UNCONTROLLED MOSAIC CONSTRUCTED
FROM 1966 REC 12-6-2 PHOTOGRAPHY
1971
Approx. Scale in Miles
0
1/2
1
TW
TW
TW
HW
FA
Beach
TW
TW
FD
FD
HA
FL

SIUSLAW RIVER
TW
TDA
PI
HA
PRX
PRA
DS
DSA
tf
Marsh
HW
DG
OA
PA
SC
DS
tfs
tfc
Beach
FD
HWS
DT
DST
TW
RS


WOAHINK
LAKE
SILTCOOS LAKE
SILTCOOS RIVER
Beach
River
Mountain Front
Marsh
Slide
TDA
PRA
OA
DSA
tf
TW
PRX
HW
DG
HA
HWS
FD
DT
PRS
PI
MDW
MTL
tfs
MSS
MSM
DS
sfr
FA
sm
RS
DST



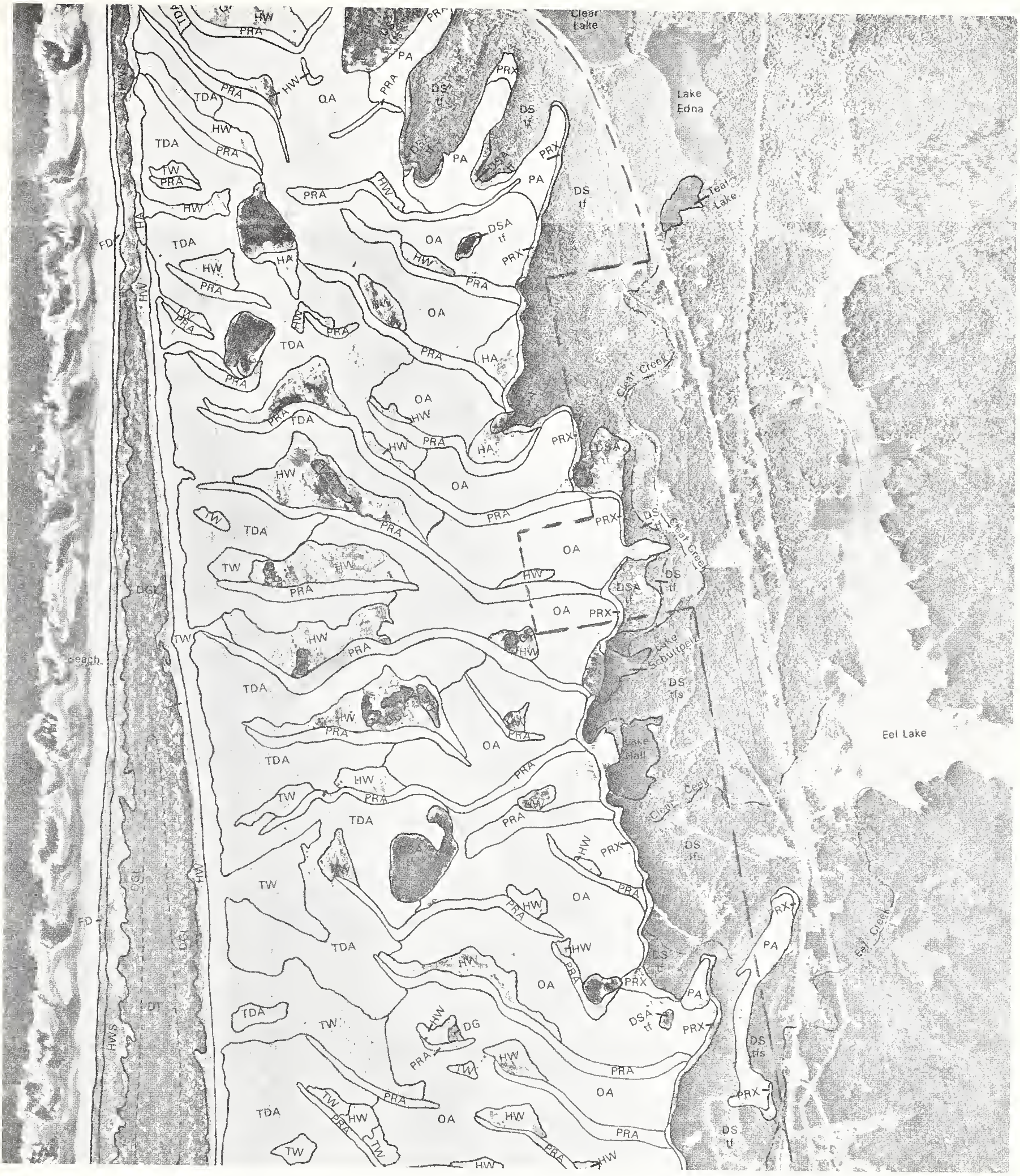
SILTCOOS
SILTCOOS LAKE
Beach
Mountain Front
Lost Lake
Dune Lake
Lake CZ
Deer Creek
FA
HW
HA
HWS
FD
DG
TDA
PRX
PRA
PI
TW
OA
DGL
DSA
SC
DS
tf
tfs
tfc
MSS
MTL
MDW
MSM
MMV
PA
DST


Beach
Tahkenitch Lake
Tahkenitch Lake
Elbow Lake
Butterfly Lake
Dune Lake
Elbow Creek SW
Elbow Creek SE
Mountain Front
MOUNTAIN FRONT
Marsh
Elbow tr.

MSS
tfs
MDW
Marsh
Mountain Front
Beach
FD
HWS
DGL
DG
TDA
PA
PRX
OA
HW
DSA
DS
Three Mile Cr.
MMV
MTL
FA
TW
UMPQUA
RIVER

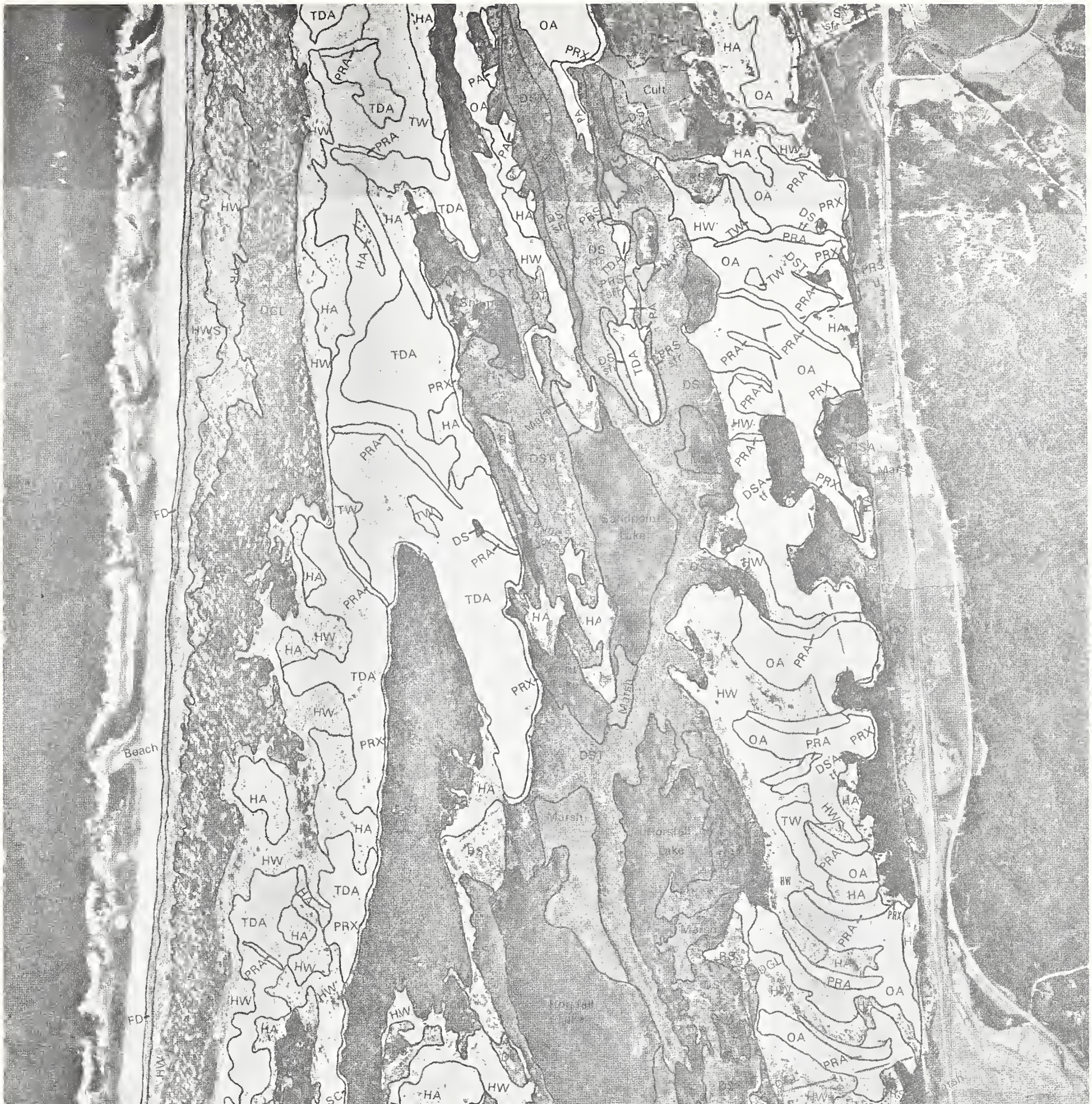
UMPQUA
RIVER
UMPQUA
RIVER
Beach
FD
HW
PA
DG
PRX
TDA
HA
TW
OA
FA
sm
PRA
DSA
HWS
DGL


HA
DGL
FD
HWS
HW
TDA
PRA
Beach
DS
PA
Mountain Front
DS
Pa
MSS
tfs
DS
tfc
PRS
tf
Clear Lake
TW
DS
tf
BSA
DB
tfs
OA
PRX


Clear Lake
Lake Edna
Teal Lake
Clear Creek
Lake Schuttpelz
Lake Hall
Eel Lake
Eel Creek
Beach
HWS
FD
DGL
DT
TDA
TW
HW
HA
PRA
PRX
PA
OA
DS tf
DS tfs
DSA tf
DG

Tenmile Creek
Douglas fir stand
Clear Lake
Saunders
EEL Creek
Marsh


Beach
Dune Lake
Saunders Lake
Butterfield Lake
Cleared land
Marsh
Cult.


TDA
HA
OA
PRX
PRA
PA
TW
HW
HWS
DSL
DS
DST
DSA
PRS
SC
Cult
Marsh
Sandpoint Lake
Horsfall Lake
Beach
FD
Pl.
OGL

Beach
HWS
FD
DGL
HW
TDA
SC
HA
PRA
PI
DSA
tf
OA
DS
DST
Marsh
PA
RS
HW
Henderson
Marsh
Abandoned
Homestead
Cleared land
Industrial Site
(Rock Surfaced)
FA
sm
Industrial Site
Paper Mill
COOS BAY

A P P E N D I X

APPENDIX TABLE 1. APPROXIMATE SURFACE ACREAGE AND DEPTH OF LAKES IN YEARS OF AVERAGE PRECIPITATION IN THE OREGON DUNES NATIONAL RECREATION AREA.[1]

Lake	Surface Acres +			Depth (feet) +	
	Maximum	Mean	Minimum	Maximum	Minimum
Bear		12		18	
Cleawox		82		48	
Siltcoos Lagoon		5		6	
Siltcoos	4250	2882	2500	18	
North Erhart		1.7		20	
Erhart		1.0		20	
Loon		3.0		20	
Taylor		3.0		19	
Carter		28		38	
Lost		5.8		30	
CZ		1.5			
Dune Lake I			1.2		
Perkins		4.7		30	
Tahkenitch		1500		21	
Elbow		12		25	
Butterfly			4.3		
Dune Lake II			3.0		
Threemile		67		32	
Schuttpelttz	5	5	5	15	12
Hall	15	15	14	42	39
Clear	26	24	22	25	20
Saunders	57	57	57	30	26
Dune Lake III	Unknown				
Milo	Unknown				
Butterfield	40	38	35	35	30
Beale	12	10	8	25	15
Snag	40	30	20	10	5
Dune Lake IV			2.5		
Sandpoint	100	80	75	12	5
Spirit	5	4	3	10	5
Horsfall	300	250	200	15	5
Bluebill	40	35	30	15	2

[1] Compiled from Hutchison, 1968, 1972 a: Schwartz, 1972; Anderson, 1972; and Saltzman, 1966.

+ Maximums occur during late winter, means during early summer, and minimums during early fall.

Note: In years of extremely low precipitation, many of the smaller and shallower lakes may dry up entirely.

APPENDIX TABLE 2. A PARTIAL CHECKLIST OF FISH SPECIES PRESENT IN LAKES OF THE OREGON DUNES NATIONAL RECREATION AREA.'

Lake	Species [+]																					
	St	Co	Ct	Ct	Rb	K	LB	Wm	BC	WC	Bg	YP	Brb	WSg	GSg	Cp	Su	Sq	Skb	RsS	Cot	Lam
Bear																				*	*	
Cleawox				*			*		*			*	*			*	*	*	*	*	*	
Siltcoos Lagoon							*		*		*		*						*	*	*	
Siltcoos	*	*		*	*	*	*		*		*	*	*	*	*		*	*	*	*	*	
North Erhart				*															*		*	
Erhart				*																		
Loon				*			*		*													
Taylor													*						*	*	*	
Carter				*			*				*		*						*	*		
Lost				*			*				*										*	
CZ				*																	*	
Dune Lake I [x]																						
Perkins				*			*			*												
Tahkenitch	*	*		*	*		*	*	*	*	*	*	*	*				*	*	*	*	
Elbow		*		*	*	*					*								*	*	*	
Butterfly [x]																						
Dune Lake II [x]																						
Threemile				*								*							*	*	*	
Schutpelttz				*			*						*						*		*	
Hall				*									*						*		*	
Clear				*	*								*								*	
Saunders	*	*	*	*	*								*						*		*	
Dune Lake III [x]																						
Milo [x]																						
Butterfield				*			*		*				*						*		*	
Beale				*			*		*		*	*	*						*		*	
Snag							*					*	*						*		*	
Dune Lake IV [x]																						
Sandpoint							*					*	*						*		*	
Spirit												*	*						*		*	
Horsfall							*					*	*						*		*	
Bluebill							*					*										

See next page for footnotes.

APPENDIX TABLE 2 (Continued)

' Compiled from Hutchison, 1968, 1972 a and b; Schwartz, 1972; Anderson, 1972; and Saltzman, 1966.

+ Species:

St - steelhead trout	Wm - warmouth bass	GSg- green sturgeon
Co - coho salmon	BC - black crappie	CP - carp
Cts - searun cutthroat trout	WC - white crappie	Su - largescale sucker
Ct - cutthroat trout (resident)	Bg - bluegill	Sq - squawfish
Rb - rainbow trout	YP - yellow perch	Skb - threespine stickleback
K - kokanee salmon	Brb - brown bullhead	RsS - redside shiner
LB - largemouth bass	WSg - white sturgeon	Cot - sculpin sp.
		Lam - pacific and western brook lamprey

x No information available on these lakes.

Note: Many of the warm water species present in these lakes are not endemic to the Region. These species were introduced and re-distributed by natural means or man. Therefore, lakes in the area may be expected to contain most of the warm water species listed.

APPENDIX TABLE 3. RECENT RECORDS OF FISH SPECIES STOCKED IN THE OREGON DUNES NATIONAL RECREATION AREA BY THE OREGON STATE GAME COMMISSION.'

	Species Stocked		Periodicity of Stocking	
Lake	Rainbow	Cutthroat	Annual	Biennial
Bear		*	ONCE IN 1964	
Cleawox		*		*
Siltcoos	*		*	
North Erhart		*	*	
Erhart		*	*	
Loon		*		*
Carter		*		*
Lost		*		*
CZ		*	*	
Perkins		*		*
Tahkenitch	*		*	
Elbow	*			*
Saunders	*	*	*	

' Data from Hutchison, 1972 c, Schwartz, 1972 and Anderson, 1972.

APPENDIX TABLE 4. ANADROMOUS AND RESIDENT FISH SPECIES[x] PRESENT IN FRESH WATER STREAMS OF THE OREGON DUNES NATIONAL RECREATION AREA. '

	ANADROMOUS				RESIDENT+						
Stream	St	Co	Ct	Lam	Ct	Rb	Cot	D	RsS	Lam	Skb
Karjaloff Cr.	*	*	*		*						
Deer Cr.		*	*		*						
Elbow Cr.		*	*		*						
Elbow Lake SE		*	*		*						
Elbow Lake SW		*	*		*						
Threemile Lake NE					*						
Threemile Cr.											*
Clear Cr.	*	*	*	*	*		*	*	*	*	*
Eel Cr.	*	*	*		*	*	*	*	*		*
Saunders Cr.	*	*	*		*	*	*	*	*		*

' Compiled from Hutchison, 1972 a and b; Schwartz, 1972; and Saltzman, 1966.

x St - steelhead trout, Co - coho salmon, Ct - cutthroat trout, Rb - rainbow trout, Cot - sculpin species, D - blackside dace, RsS - Redside shiner, Lam - pacific and western brook lamprey, Skb - threespine stickleback.

+ Resident species, except rainbow, are indigenous to the region and should be present in all the streams. Rainbow are stocked in some lakes by the Oregon State Game Commission. Occasionally rainbow and warm water fish species move from the lakes into inlet and outlet streams.

APPENDIX TABLE 5. PARTIAL CHECKLIST OF ANADROMOUS, WARM WATER AND BAY-OCEAN FISH WHICH SPEND ALL OR PARTS OF THEIR LIVES IN ESTUARIES OF STREAMS AND RIVERS IN THE OREGON DUNES NATIONAL RECREATION AREA.'

	Stream - River					
Species	Siuslaw	Siltcoos	Tahkenitch	Threemile	Umpqua	Tenmile
Anadromous						
Pacific lamprey	*	*	*			*
White sturgeon	*	*			*	
American Shad	*				*	*
Striped bass	*	*			*	
Chum salmon						
Coho salmon	*	*	*		*	*
Chinook salmon	*				*	*
Steelhead	*	*	*		*	*
Cutthroat trout	*	*	*		*	*
Warm Water +						
Largescale sucker	*	*			*	
Threespine stickleback	*	*	*	*	*	*
Redside shiner					*	*
Umpqua squawfish					*	
Largemouth bass					*	
Blackside dace						*
Brown bullhead					*	*
Black crappie					*	
Bluegill						*
Bay - Ocean x						
Leopard shark						
Spiny dogfish						
Longnose skate						
Green sturgeon	*	*			*	
Pacific herring	*				*	
Northern anchovy					*	
White bait smelt						
Surf smelt					*	
Eulachon	*	*			*	
Longfin smelt						
Longnose lancet						
Pacific tomcod	*				*	
Topsmelt					*	
Jacksmelt						
Tubesnout						
Bay pipefish					*	
Pomfret						
White sea bass						

APPENDIX TABLE 5 (Cont.)

Species	Stream - River					
	Siuslaw	Siltcoos	Tahkenitch	Threemile	Umpqua	Tenmile
Bay - Ocean [x]						
Shiner perch	*				*	*
Striped perch	*				*	
Silver surf perch					*	
Walleye surf perch	*				*	
White sea perch	*				*	
Pile perch	*	*			*	
Redtail surf perch	*				*	
High cockscomb						
Snake prickleback						
Penpoint gunnel						
Saddleback gunnel						
Wolf-eel					*	
Pacific sand lance					*	
Arrow gobby					*	
Bay gobby						
Pacific pampano						
Cooper rockfish						
Bocaccio						
Kelp greenling	*				*	
Rock greenling	*				*	
White-spotted greenling	*				*	
Lingcod	*				*	
Padded sculpin						
Mosshead sculpin						
Prickly sculpin		*			*	*
Buffalo sculpin	*				*	
Staghorn sculpin	*	*			*	*
Tide pool sculpin						
Silver-spotted sculpin					*	
Sharp-nosed sculpin					*	
Black rockfish					*	
Fluffy sculpin						
Cabezon	*				*	
Tubenose poacher						
Speckled sanddab					*	
English sole					*	
Starry flounder	*	*			*	*
Sand sole	*				*	

' Compiled from Hutchison, 1972 a and b; Schwartz, 1972; and Anderson, 1972.

* Species checklist based on fish species present in Coos Bay, Oregon. (Cummings and Schwartz, 1971)

+ Some warm water species move into estuaries from the fresh water portions of streams and rivers, or from the lakes which these streams and rivers drain.

x Nearly all of these ocean and bay fish are indigenous to the region and should be present in the estuaries of the Siuslaw and Umpqua Rivers. Some, but not all ocean and bay fish, may be expected to utilize the estuaries of smaller streams such as Siltcoos River, Tahkenitch Creek, Threemile Creek & Tenmile Creek.

APPENDIX TABLE 6. STREAMS AND RIVERS OF THE OREGON DUNES NATIONAL RECREATION AREA, WHICH RESIDENT AND ANADROMOUS SALMONOIDS UTILIZE FOR SPAWNING, REARING, OR AS MIGRATION ROUTES.

	Anadromous+				Resident+	Stream Use		
Stream	St	Co	Ch	Ct	Ct	Spawning	Rearing	Migration
Siuslaw River	*	*	*	*			*	*
Siltcoos River	*	*		*			*	*
Karjaloff Cr.	*	*		*	*	*	*	
Deer Cr.		*		*	*	*	*	
Tahkenitch Cr.	*	*		*			*	*
Elbow Cr.		*		*			*	*
Elbow Lake SE		*		*	*	*	*	
Elbow Lake SW		*		*	*	*	*	
Threemile Lake NE					*	*	*	
Threemile Cr.					*			
Umpqua River	*	*	*	*			*	*
Tenmile Cr.	*	*		*	*		*	*
Clear Cr.	*	*		*	*	*	*	*
Eel Cr.	*	*		*	*	*	*	*
Saunders Cr.	*	*		*	*		*	*

' Compiled from Hutchison, 1972 a and b; Schwartz, 1972; Anderson, 1972; and Saltzman, 1966.

+ St - steelhead, Co - coho salmon, Ch - chinook salmon, Ct - cutthroat trout.

APPENDIX TABLE 7. ESTIMATED NUMBER OF RECREATION DAYS AND SPORTS CATCH OF FISH IN LAKES OF THE OREGON DUNES NATIONAL RECREATION AREA FOR 1971.'

Lake	Number of Recreation Days#	Estimated Catch+				
		WW	Rb	Ct	Co	St
Bear	0	-	-	-	-	-
Cleawox	2,000	270	-	2,400	-	-
Siltcoos Lagoon	100	140	-	-	-	-
Siltcoos	50,000	178,850	5,000	3,000	800	50
North Erhart	75	-	-	150	-	-
Erhart	100	-	-	250	-	-
Loon	300	20	-	500	-	-
Taylor	0	0	-	-	-	-
Carter	3,000	40	-	3,000	-	-
Lost	1,000	20	-	1,000	-	-
CZ	50	-	-	200	-	-
Dune Lake I*			-		-	-
Perkins	300	25	-	600	-	-
Tahkenitch	21,000	77,000	3,000	500	400	20
Elbow	1,200	60	?	900	10	-
Butterfly*						
Dune Lake II*						
Threemile	75	60	-	40	-	-
Schutpelttz*			-		-	-
Hall*			-			
Clear	590	15	150	200	-	0
Saunders	5,570	30	3,000	200	0	0
Dune Lake III*						
Milo*						
Butterfield*						
Beale	1,380	515	-	50	-	-
Long*						
Snag	55	60	-	-	-	-
Dune Lake IV*						
Sandpoint	75	45	-	-	-	-
Spirit*						
Horsfall	170	130	-	-	-	-
Bluebill	?	30	-	-	0	-

' Compiled from Hutchison, 1972 a and b; Schwartz, 1972; and Anderson, 1972.

Recreation days = catch/angler/trip x annual catch (Schutpelttz to Bluebill Lake). Recreation days (Bear to Threemile Lake) = number of angler trips per year.

+ WW- warm water species, Rb - rainbow trout (stocked), Ct - cutthroat trout (resident, searun and stocked), Co - coho salmon, St - steelhead trout.

* No information available for these lakes.

APPENDIX TABLE 8. ESTIMATED SPORTS CATCH OF ANADROMOUS, RESIDENT AND OCEAN-BAY FISH IN STREAMS AND RIVERS WITHIN THE OREGON DUNES NATIONAL RECREATION AREA FOR 1971.'

Species	Stream - River							
	Siuslaw	Siltcoos	Tahkenitch	Umpqua	Clear	Eel	Tenmile	Saunders
Anadromous								
Coho salmon)		200	50	)	0	0	2,975	0
)	600	-	-	) 3,000				
Chinook salmon)				)	-	-	-	-
Steelhead trout	*	50	5	*	0	0	550	0
Cutthroat trout	*	200	15	500	0	0	1,000	0
Shad	*	-	-	2,750	-	-	-	-
Striped bass	*	+	+	5,000	-	-	-	-
Resident								
Cutthroat trout	-	*	*	-	0	200	450	10
Rainbow trout	-	10	5	-	10	100	400	-
Green sturgeon	*	)	-	)	-	-	-	-
		) 50		) 600				
White sturgeon	*	)	-	)	-	-	-	-
Warm water	-	420	875	-	*	*	*	*
Ocean - Bay	x11,000	+	+	60,000	-	-	+	-

' Compiled from Hutchison, 1972 a and b; Schwartz, 1972; and Anderson, 1972.

+ Species probably present but no sports fishery known to exist for them.

* Species were caught by fishermen but no estimate of catch available.

x The majority of these were flounders and sole (Family Pleuronectidae) and sea perch (Family Embiotociae).

APPENDIX TABLE 9. DISTRIBUTION AMONG HABITATS AND ABUNDANCE OF AMPHIBIANS AND REPTILES IN THE OREGON DUNES NATIONAL RECREATION AREA JANUARY TO MAY, 1972.

SPECIES[#]	HABITATS (See page 47 for coding)																					ABUNDANCE[x]
	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2	
AMPHIBIANS																						
NORTHWESTERN SALAMANDER	*	+			+	*	*											*			*	P
PACIFIC GIANT SALAMANDER	+	+			+	+	+											*			*	P
OLYMPIC SALAMANDER	*	*			+	*	*											+			*	U
ROUGH SKINNED NEWT	*	*		*	*	*	*								*	*	*	*	*	*	*	VC
DUNNS SALAMANDER						+	*											*			*	P
WESTERN RED-BACKED SALAMANDER						*	*										*	*	*	*	*	C
OREGON SALAMANDER						*	*									*	*	*	*	*	*	C
CLOUDED SALAMANDER						+	*										*	*	*	*	*	C
WESTERN TOAD	+	+	+	+	+	+	+	+	*	*	+	*	+	+	+	+	+	+	+	+	+	P
PACIFIC TREEFROG	*	*		*	+	*	+		+	*	+	*	*		*	*	*	+				VC
RED-LEGGED FROG	*	*	*	*	*	*	*			*		*	*		*		*	*			*	VC
BULLFROG	*	*		*	*		*															C
REPTILES																						
NORTHERN ALLIGATOR LIZARD						+			*					+	*	*		+	*	*		C
COMMON GARTER SNAKE			*	*	*	*	*		*	*		*	*		*	*			+	+		C
NORTHWESTERN GARTER SNAKE				+		+								+	*	*		+	*	*		C

See next page for footnotes.

APPENDIX TABLE 9. (CONTINUED)

SPECIES CHECKLIST FROM THE OBSERVATIONS OF SILOVSKY, 1972.

* SPECIES OBSERVED IN THIS HABITAT.

+ SPECIES NOT OBSERVED IN THIS HABITAT BUT EXPECTED TO USE IT.

x ABUNDANCE GIVEN IS FOR THE ENTIRE N.R.A.

- VC - VERY COMMON; 25 OR MORE INDIVIDUALS FOUND PER 8 HOUR SEARCH OF HABITAT(S)
- C - COMMON; 5-10 INDIVIDUALS FOUND PER 8-HOUR SEARCH OF HABITAT(S)
- U - UNCOMMON; 1-5 INDIVIDUALS FOUND PER 8-HOUR SEARCH OF HABITAT(S)
- P - PRESENT; LESS THAN 5 INDIVIDUALS FOUND DURING THIS STUDY. THIS INDICATES THESE SPECIES WERE DIFFICULT TO FIND. THEY MAY RANGE IN ABUNDANCE FROM RARE TO VERY COMMON.

APPENDIX TABLE 10. DISTRIBUTION AMONG HABITATS AND ABUNDANCE OF TERRESTRIAL MAMMALS IN THE OREGON DUNES NATIONAL RECREATION AREA.'

SPECIES	HABITATS (See page 47 for habitat coding)																									ABUNDANCE
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2	
TROWBRIDGE SHREW											*									+	+	+	+	+	*	C
VAGRANT SHREW							+	+		+	*			*		*										C
PACIFIC SHREW											*									+	+	+	*	+	*	C
MARSH SHREW								+		+	+															P
SHREW MOLE																				*	+	+		+	+	C
PACIFIC MOLE												*	*		*			*	*	*	*	*	*	*	*	VC
LITTLE BROWN BAT																	+			+	+		+	+		P
YUMA BAT																				*	*		+			U
LONG-EARRED BAT																			+	+	+		+			P
FRINGED BAT	unknown																									P
LONG-LEGGED BAT																				+	+					P
CALIFORNIA BAT																				*	*					C
SILVER-HAIRED BAT																			+	+	+					P
BIG BROWN BAT																			+	+	+					P
HOARY BAT																			+	+	*					P
WESTERN BIG-EARRED BAT																				+	+					P
BLACK BEAR								*		+									*	*	*	+	*	*	+	P
RACCOON		+		*			*	*	*	+	*	*	*	*	*	*	*	*	*	*	*	+	*	*	+	C
MARTEN																					+	+		+	+	P
SHORT-TAIL WEASEL								+	+	+	+									+	+	+		+	*	P
LONG-TAIL WEASEL								+	+	+	*									+	+	+		+	+	P
MINK		+		+			*	*	*	+	*		+	*	+	+	+	*	+	*	*	+	+	+	+	C
RIVER OTTER					*	*		+	+		*															C
SPOTTED SKUNK		+								+									+	+	*	+	+	+	+	C

APPENDIX TABLE 10. (CONTINUED)

SPECIES	HABITATS																									ABUNDANCE[x]
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2	
STRIPED SKUNK		+		+			*	*				*	*	*	*	*		*					*			C
COYOTE							+	+		+		+	+	+	+	+		+	+	+	*	+	*	*	+	U
GRAY FOX							+	+		+		+	+	+	+	+		+	+	*	+		+			P
MOUNTAIN LION																			+	+	*	+	+	+	+	O
BOBCAT		+		+			+	+		+		+	*	+	+	+	+	*	+	*	*	+	*	*	+	C
MOUNTAIN BEAVER																						+	+	+	*	U
CALIFORNIA GROUND SQUIRREL		*										*	*		*			*		+						C
TOWNSEND CHIPMUNK																			*	*	*	*	*	*	*	VC
CHICKAREE																			*	*	*	*	*	*	*	VC
FLYING SQUIRREL																					+	*		+	*	U
BEAVER					*	*		*	*	*	*						*		*							C
DEER MOUSE		*					*	*		*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	VC
BUSHY-TAIL WOODRAT																				*	*	*	*	+	+	C
WHITE-FOOTED VOLE											*															VR
RED TREE MOUSE																					+	+		+		R
CALIFORNIA RED-BACK VOLE																				*	+	+			*	C
TOWNSEND VOLE							*	*		*	*			*		*										VC
LONGTAIL VOLE										+	+															P
OREGON VOLE																				+	+	*	*	+		VC
MUSKRAT					*	*		*	*	*	*															C
PACIFIC JUMPING MOUSE										+	*									+	+	+	+	+	+	C
PORCUPINE																		+	+	+	+		+	+	+	O
SNOWSHOE HARE										+											+	+	+	+	*	U

APPENDIX TABLE 10. (CONTINUED)

SPECIES	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2	ABUNDANCE[x]
BRUSH RABBIT													*			*	*	*	*	*	*	+	*	*	*	VC
BLACK-TAILED DEER		*					*	*		*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	VC
ROOSEVELT ELK																			+	+	+	+	+	+	+	O

' Species checklist from Maser, 1972; Moody and Ternyik, 1950; Pimentel, 1950; Reardon, 1959 and Silovsky, 1972.

x Abundance from Silovsky, 1972 and Maser, 1972. "Observations" are sightings of the animal trapping records or sign the animal leaves (tracks, droppings, nests)

VC - very common; 25 or more observations per day
C - common; 5-25 observations per day
U - uncommon, 0-5 observations per day
R - rare; extensive search required to locate individuals
VR - very rare; species seldom if ever encountered
P - present; species present but level of abundance not determined
O - occasional, species visit the area several times a year or during a period of years

* Species observed in this habitat.
+ Species not observed in this habitat but expected to use it.

APPENDIX TABLE 11. HABITAT, STATUS, PERIOD OF USE AND ABUNDANCE OF COASTAL MARINE MAMMALS UTILIZING THE OREGON DUNES NATIONAL RECREATION AREA.[1]

Species	Habitat	Status	Period of Use	Abundance
Steller's sea lion	open ocean, estuary (river mouth)	summer-fall resident	May - Dec.	uncommon
California sea lion	open ocean, estuary (river mouth)	migrant	Aug.- Feb.	uncommon
Harbor seal	open ocean, estuary (river mouth)	resident	entire year	common
Elephant seal	open ocean, beach	wanderer	entire year	very rare

[1] Based on the observations of Mate (1972 a).

APPENDIX TABLE 12. CHECKLIST OF THE PELAGIC MARINE MAMMALS WHICH OCCUR OFF THE OREGON COAST.'

SPECIES (Common name)	Scientific Name
Bairds beaked whale	Berardius bairdi
Cuviers beaked whale	Ziphius cavirostris
Hubbs beaked whale	Mesoplodon carlhubbsi
Sperm whale	Physter catodon
Pigmy sperm whale	Kogia breviceps
Common dolphin	Delphinus delphis
Right whale dolphin	Lissodelphis borealis
Long beak dolphin	Stenella euphrosyne
Spotted dolphin	S. graffmani
Bottle-nose dolphin	Tursiops truncatus
Striped dolphin	Lagenorphynchus obliquidens
Rissos dolphin	Grampus griseus
Rough-toothed dolphin	Steno bredanensis
Killer whale	Orcinus orca
False killer whale	Pseudorca crassidens
Pacific blackfish	Globicephala scammoni
Harbor porpoise	Phocoena phocoena
Dall porpoise	Phocoenoides dalli
Gray whale	Eschrichtus gibbosus
Finback whale	Balaenoptera physalus
Sei whale	B. borealis
Little piked whale	B. acutorostrata
Blue whale	B. musculus
Humpback whale	Megaptera novaengliae
Pacific right whale	Balaena gracialis

' Compiled from a review of the literature by Mate (1972b)

APPENDIX TABLE 13. DISTRIBUTION AMONG HABITATS, AND ABUNDANCE OF RESIDENT BIRDS ON THE OREGON DUNES NATIONAL RECREATION AREA.[1]

SPECIES	HABITATS (See page 47 for habitat coding)																									ABUNDANCE[x]
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2	
COMMON LOON			*	*	+	*																				VC
PIED-BILLED GREBE				+	*	*	*	*	*		*															C
FORKED-TAILED PETREL			+																							C
DOUBLE-CRESTED CORMORANT			*	*		*																				VC
BRANDT'S CORMORANT			*	*																						C
PELAGIC CORMORANT			*	*																						C
GREAT BLUE HERON				*	*	*	*	*	*	*	*			*		*										C
GREEN HERON				+	*	*	+	*	+	+	*			+												R
BLACK-CROWNED NIGHT HERON					+			+	+	+	+			+												R
AMERICAN BITTERN					+		+	*	+	+	+			*												U
MALLARD				*	*	*	*	*	*		*			*		*										C
WOOD DUCK					+	*		*	*		*			*		+										U
HOODED MERGANSER					+	*		+	*		+															U
SHARP-SHINNED HAWK																	*	+	+	+	+	+	+	+	+	U
COOPER'S HAWK																	+	+	+	+	+	+	+	*	+	U
RED-TAILED HAWK							+						+	*	*	+	+	+	*	*	*	+	*	*	+	U
BALD EAGLE				*	+	+	*				*										+	+				R
MARSH HAWK							*	*			*		*	*	*	*										U
SPARROW HAWK							*	*			+		*	*	*	*		+								U

APPENDIX TABLE 13. (CONTINUED)

SPECIES	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2	ABUNDANCE[x]
BLUE GROUSE																						+	+	+	+	R
RUFFED GROUSE																					+	+	+	*		U
CALIFORNIA QUAIL															+	+	+	+		*	*		+	+		U
MOUNTAIN QUAIL													*	*	*	*	*	*		*	*		*	*		C
RING-NECKED PHEASANT													+	*	*	*	*	*								U
VIRGINIA RAIL							+	*	+																	R
COOT				*	*	*	*	*	*		+			*		+										VC
BLACK OYSTER CATCHER	+																									R
SNOWY PLOVER		*		*									+		+											U
KILLDEER				*			*	*					*	*	*											C
COMMON SNIPE								*		+	+			*		*										C
SPOTTED SANDPIPER								*	*		*			*												U
GLACOUS-WINGED GULL	*	*	*	*	+	+					*															VC
WESTERN GULL	*	*	*	*	+	+					+															VC
COMMON MURRE			*	*																						VC
PIGEON GILLEMOT			*	*																						C
MARBLED MURRELET			*	*	+																					U
CASSINS AUKLET			+																							C
RHINOCEROUS AUKLET			+	+																						C

APPENDIX TABLE 13. (CONTINUED)

SPECIES	HABITATS J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HwS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2	ABUNDANCE[x]
TUFTED PUFFIN			+																							U
BARN OWL																				+	+	+	+			U
SCREECH OWL																			+	+	*	+	+	+		U
GREAT HORNED OWL							+	+		+			+	+	+	+	+	+	+	+	*	*	+	+		U
PIGMY OWL							+	+		+			+	+	+	+	+	+	+	+	+	+	+	+		C
LONG-EARED OWL																				+	+	+	+			R
SHORT-EARED OWL							+	+		+			+	+	+	+				+	+		+			U
SAW-WHET OWL																			+	+	+	+	+			U
BELTED KING FISHER				*	*	*		*	*		*															U
RED-SHAFTED FLICKER							*						*	*		*	*	*	*	*	*	*	+	*		C
PILEATED WOODPECKER																				+	+	*				U
YELLOW-BELLIED SAPSUCKER																			+	+	*	+				R
HAIRY WOODPECKER																			*	*	*	*		+		U
DOWNY WOODPECKER																			*	*	*	*		+		U
HORNED LARK							+						+	+	+											?
GRAY JAY																				+	+	+	+	+		R
STELLER'S JAY										*								+	*	*	*	*	*	*		VC
COMMON RAVEN		B*		*			*				*			*					*	*	*	*	+			U

APPENDIX TABLE 13. (CONTINUED)

SPECIES	HABITATS																								ABUNDANCE^x
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2	
COMMON CROW		*		*			*				*		*	*		*			*	*	*	*	*			VC
BLACK-CAPPED CHICKADEE										+									*	*	*	+	+	+	+	U
CHESTNUT-BACKED CHICKADEE										*							+	+	*	*	*	*	+	*	*	VC
COMMON BUSHTIT										+						*	*		*	*	*		+	+	+	VC
WHITE-BREASTED NUTHATCH																			+	+	+	*			+	U
RED-BRESTED NUTBATCH																			+	+	+	+			+	U
BROWN CREEPER																			*	+	*	+			+	U
WRENTIT										*							*		*	*	*		+	*		VC
WINTER WREN										*									+	*	*			*		C
BEWICK'S WREN										+									*	*	*		*	*		C
LONG-BILLED MARSH WREN							+	*	*	*	*															C
ROBIN							*			+			*	*		*	*		*	*	*		*	*		VC
HERMIT THRUSH																			+	*	*	*	+	*		U
WESTERN BLUEBIRD										+									+	+	+		+	+		R
GOLDEN-CROWNED KINGLET																			*	*	*	+		*	+	C
RUBY-CROWNED KINGLET										+									*	*	*	+		*	+	C
CEDAR WAXWING										*									*	*	*			+		C
STARLING							*						+	+	+	+		+	+	*	*					C
HUTTON'S VIREO										+									+	*	*					U

APPENDIX TABLE 13. (CONTINUED)

SPECIES	HABITATS																									ABUNDANCE
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2	
AUDUBON'S WARBLER										+						+	*	+	*	*	*		*	*		<u>C</u>
HOUSE SPARROW													*													<u>U</u>
WESTERN MEADOWLARK							*							*		*										<u>C</u>
RED-WINGED BLACKBIRD							*	*	*	*	+			*		*										<u>C</u>
BREWER'S BLACKBIRD							*						*	*	+	*										<u>C</u>
EVENING GROSBEAK										+									+	+	+	+	+	+	+	<u>U</u>
PURPLE FINCH										*								+	*	*	*		*	*		<u>VC</u>
HOUSE FINCH							+						+	+	+	+					*					<u>U</u>
PINE SISKIN																			+	+	*	+		+	+	<u>I</u>
AMERICAN GOLDFINCH							*						*	*	*	*		+					*			<u>VC</u>
LESSER GOLDFINCH							+						+	+	+	+		+					+			U
RED CROSSBILL																		+	+	+	+	+		+	+	?
RUFOUS-SIDED TOWHEE										*							*		*	*	*			*		<u>C</u>
SAVANNAH SPARROW							X					*	*	*	*	*		*								<u>VC</u>
OREGON JUNCO										*						+		*	*	*	*		*	*		<u>VC</u>
WHITE-CROWNED SPARROW							X					*	*	*	*	*	*	*					+			<u>VC</u>
FOX SPARROW																				*	*	*			*	<u>U</u>
SONG SPARROW							X			*		+	*	*	*	*	*	*	*	*	*		*	*		<u>VC</u>

' Species checklist from Bertrand and Scott, 1971; Gabrielson and Jewett, 1940; Giesler, 1952; Pimentel, 1950; Reiher, 1972; Scott, 1972; Silovsky, 1972; and Wampole, 1971a and 1971b.

* Species observed in this habitat

+ Species not observed in this habitat but expected to use it

X Abundance: Key to abundance and abundance of birds not observed after Bertrant and Scott, 1971. Abundance <u>underlined</u> determined from this study, Silovsky,1972

VC - very common; 50 or more birds observed per day
C - common; 10-49 birds observed per day
U - uncommon; 0-9 birds observed per day
R - rare; 5 or less birds observed per year

O - occasional; not seen every year but occurs regularly
I - irregular; abundance and/or occurance fluctuates greatly from year to year
? - unknown; most of these species are probably irregular, occasional or rare

APPENDIX TABLE 14. DISTRIBUTION AMONG HABITATS, ABUNDANCE AND THE PERIOD OF USE FOR BIRD RESIDENTS ON OR VISITING THE OREGON DUNES NATIONAL RECREATION AREA DURING THE SUMMER.'

SPECIES	HABITATS (See page 47 for habitat coding)																									ABUNDANCE[x]	PERIOD OF USE
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2		
BLACK FOOTED ALBATROSS			+																							C	May - Aug.
LEACH PETREL			+																							U	May - Aug.
BROWN PELICAN			+	+																						R	June - Oct.
BLUE-WING TEAL				+		+	+	*	+					+												U	?
CINNAMON TEAL				*		+	*	+	+					*												U	April - Oct.
TURKEY VULTURE		*									*		+	+	+	+		+	+	*	*	*	+			C	Mar. - Sept.
OSPREY		*		*	*	*		*	+		*															U	April - Oct.
SORA RAIL					+			*	+																	R	April - Oct.
HEERMAN'S GULL	+	X	+	+																						C	July - Dec.
BAND-TAILED PIGEON																			*	*	*	*	*	*	*	C	April - Oct.
MOURNING DOVE													*						*	*	*		+	+		U	April - Oct.
COMMON NIGHTHAWK													*	+	+	*	*	+	+	*	*	+	+	+	+	U	June - Sept.
VAUX'S SWIFT																			+	+	+	+		+	+	?	June - Oct.
RUFOUS HUMMINGBIRD										*						*	*	+	*	*	*	*	*	*		VC	Mar. - Sept.
ALLEN'S HUMMINGBIRD																	+		+	+	*		+	+		R	?
WESTERN KINGBIRD																				*	*					R	April - Aug.
TRAILL'S FLYCATCHER										+	*								*	*	*					U	May - Sept.
HAMMOND'S FLYCATCHER										+									+	+	+	+		+		R	May - Sept.
DUSKY FLYCATCHER										+							+		*	+	+		+	+		R	?
WESTERN FLYCATCHER										+									*	*	*			+		C	May - Aug.
WESTERN WOOD PEEWEE										+									*	*	*	+		+		C	May - Aug.
OLIVE-SIDED FLYCATCHER										+									*	*	*			+		VC	May - Sept.

APPENDIX TABLE 14. (CONTINUED)

SPECIES	HABITATS																									ABUNDANCE[x]	PERIOD OF USE
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2		
VIOLET-GREEN SWALLOW											*								*	*	+	*	*	*	*	U	Feb. - Sept.
TREE SWALLOW											*								*	*	*	*	*	*	*	VC	Mar. - Sept.
BANK SWALLOW											*									+	+	+	+	+	+	R	April - Sept.
ROUGH-WINGED SWALLOW											*								*	*	*	*	+	*	*	U	April - Aug.
BARN SWALLOW											*									+	*	*	*	*	*	VC	April - Sept.
CLIFF SWALLOW											*									+	*	*	+	*	*	VC	April - Sept.
PURPLE MARTIN											*								*	*	*	+	+	+	+	R	April - Sept.
HOUSE WREN																			+	+	+					R	April - Sept.
SWAINSON'S THRUSH										+									*	*	*		*	*		VC	May - ?
SOLITARY VIREO										+									+	+	+					R	April - Sept.
WARBLING VIREO										+									+	+	+					R	May - Sept.
ORANGE-CROWNED WARBLER										+	+						+		*	*	*		*	+		VC	April - Sept.
NASHVILLE WARBLER																				+	+		+			R	April - Aug.
YELLOW WARBLER										+	*								+	*	*					U	?
BLACK-TROATED GREY WARBLER																			+	+	*		+			U	April - Sept.
HERMIT WARBLER																			+	+	+	+		+	+	R	May - Aug.
MAC GILLIVRAY'S WARBLER										+	+								+	+	*		+	+		U	April - Sept.
YELLOWTHROAT								+	+	+	*								+							U	April - Sept.
YELLOW-BREASTED CHAT										+	*								+	+	+					R	May - Aug.
WILSON'S WARBLER										+	*								+	+	*					VC	?
BROWN-HEADED COWBIRD							+					+	*	*	*	*		+	*	*	*					VC	May - Sept.
WESTERN TANAGER																			+	+	+	+		+	+	?	April - Sept.
BLACK-HEADED GROSBEAK										+	*								+	+	*		+			U	May - Aug.
LAZULI BUNTING										+	+						+		+	+	+		+	+		?	May - Sept.

APPENDIX TABLE 14. (CONTINUED)

SPECIES	HABITATS																									ABUNDANCE[x]	PERIOD OF USE
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2		
VESPER SPARROW							+					+	+	+	+	+		+					+			?	Mar - Sept.
LINCOLN'S SPARROW							+	+		+	+	+		+		+										?	April - Oct.
CHIPPING SPARROW							+					+	+	+	+	+										?	?

' Species checklist and period of use from Bertrand and Scott, 1971; Gabrielson and Jewett, 1940; Giesler, 1952; Pimentel, 1950; Hecher, 1972; Scott, 1972; Silovsky, 1972; and Wampole, 1971a and 1971b.

* Species observed in this habitat

+ Species not observed in this habitat but expected to use it

x Abundance: Key to abundance and abundance of birds not observed after Bertrant and Scott, 1971. Abundance, underlined, determined from this study, Silovsky, 1972.

VC - very common; 50 or more birds observed per day
C - common; 10-49 birds observed per day
U - uncommon; 0-9 birds observed per day
R - rare; 5 or less birds observed per year
? - unknown; most of these species are probably irregular, occasional or rare

APPENDIX TABLE 15. DISTRIBUTION AMONG HABITATS, ABUNDANCE AND THE PERIOD OF USE FOR BIRDS RESIDING ON THE OREGON DUNES NATIONAL RECREATION AREA DURING WINTER.'

SPECIES	HABITATS (See page 47 for habitat coding)																									ABUNDANCE[x]	PERIOD OF USE
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2		
ARCTIC LOON			*	*		*																				U	Nov. - May
RED-THROATED LOON			*	*		*																				U	Nov. - April
RED-NECKED GREBE				*		*		*	+																	U	?
HORNED GREBE				*		*		*	+																	VC	Sept. - May
EARED GREBE				*		*		*	+																	U	?
WESTERN GREBE			*	*		*																				VC	Sept. - May
FULMAR			+																							VC	Sept. - Feb.
COMMON EGRET				*	*	*	*	*	+	+	*			+												U	Sept. - June
WHISTLING SWAN				*	+	*	+	*	+					*		*										VC	Nov. - Mar.
BLACK BRANT			*	*			+																			U	Dec. - May
EMPEROR GOOSE				+		+																				O	Oct. - Feb.
GADWALL				*			*							*		*										U	? - April
PENTAIL				*	+	*	*	*	+					*		*										VC	Oct. - May
EUROPEAN WIDGEON				+		+	+							+												R	Nov. - Jan.
AMERICAN WIDGEON				*			*		+					*		*										VC	Oct. - April
SHOVELER				+		+	*	+	+					*		*										U	Nov. - May
REDHEAD				*		*		+	+					*												U	? - Mar.
RING-NECKED DUCK				+		*		*	*					+		*										C	Sept. - April
CANVASBACK				*		*		*	+					*												C	Sept. - May
GREATER SCAMP				*		*																				C	Oct. - Feb.
LESSER SCAMP				*		*																				VC	Sept. - May
COMMON GOLDENEYE				*		*		*	+					+												U	Nov. - Mar.
BARROW'S GOLDENEYE				+		*		+	+																	R	? - Mar.

APPENDIX TABLE 15. (CONTINUED)

SPECIES	HABITATS																								ABUNDANCE^{x}	PERIOD OF USE
	J	B	O	E	R-S	L-P	SM	M	MMS	MMV	R-L	FD	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS_1	TFS_2		
BUFFLEHEAD				*		*		*	+					+												C	Oct. - April
OLD SQUAW			+	*																						O	Nov. - Mar.
HARLEQUIN DUCK			+	*																						R	Aug. - May
WHITE-WINGED SCOTER			*	*		*																				VC	? - April
SURF SCOTER			*	*																						VC	Aug. - May
COMMON SCOTER			*	+																						U	Nov. - Feb.
RUDDY DUCK				*		*		*	+																	VC	Sept. - Mar.
RED-BREASTED MERGANSER				*	*																					C	Nov. - May
ROUGH-LEGGED HAWK								+	+			+		+	*		+									R	Oct. - April
PEREGRINE FALCON		+		+			+	+	+	+	+		+	+	+	+	+	+	+	+	*					O	? - Mar.
PIGEON HAWK				*									+	+	+	+	+	+	+	+	*	+	+	+		R	? - Feb.
BLACK-BELLIED PLOVER		*		*			*	+						+												U	Sept. - May
SURFBIRD	+																									R	Aug. - Apr.
BLACK TURNSTONE	+																									R	Aug. - April
GREATER YELLOWLEGS							*	+	+					*												U	Aug. - April
ROCK SANDPIPER	+																									R	Oct. - April
LEAST SANDPIPER		*		*			*	+																		VC	July - ?
DUNLIN		*		*			*	+																		C	Oct. - May
SANDERLING		*		*																						VC	Aug. - May
GLAUCOUS GULL	*	*		*																						R	Dec. - April
HERRING GULL	*	*	*	*		+																				C	Dec. - April
CALIFORNIA GULL	*	*	*	*		+																				VC	Aug. - April
RING-BILLED GULL	*	*	*	*		+																				C	Aug. - April
MEW GULL	*	*	*	*																						VC	Aug. - April

APPENDIX TABLE 15. (CONTINUED)

SPECIES	J	B	O	E	R-S	L-P	SH	M	MMS	MMW	F-L	TO	HWS/HW	DG	HA	DGL	DT	P	DST	SFR	TF	TFO	TFC	TFS	TFS_2	ABUNDANCE[x]	PERIOD OF USE
BLACK-LEGGED KITTIWAKE				*	*																					C	Dec. - June
ANCIENT MURRELET			+	+	+																					U	Aug - April
PARAKEET AUKLET			+	+																						O	Jan., Feb.
HORNED PUFFIN			+	+																						O	Dec. - Mar.
SNOWY OWL							+						+	+	+											I	Nov., Dec.
ANNA'S HUMMINGBIRD														unknown												R	?
LEWIS WOODPECKER										+									+	+	+	+				O	?
MOUNTAIN CHICKADEE										+									+	+	+	+		+	+	O	?
VARIED THRUSH										+							*		*	*	*	*	*	*	*	VC	Sept. - Apr.
TOWNSEND SOLITARE																			+	+	+	+		+	+	?	?
WATER PIPIT							+						+	+	+	+										?	Sept. - April
BOHEMIAN WAXWING																			+	+	+					I	Nov. - Mar.
NORTHERN SHRIKE							+						+	+		+	*	+								O	Oct. - Mar.
MYRTLE WARBLER										+						*	*	+	*	*	*	*	*	*		VC	Oct. - May
TOWNSEND WARBLER																			+	+	+	+		+	+	?	?
SLATE-COLORED JUNCO										+									+	+	+		+	+		R	Oct. - Mar.
HARRIS SPARROW							+					+	+	+	+	+										O	?
GOLDEN-CROWNED SPARROW							+						*	*	*	*							+			U	Sept. - May
WHITE-THROATED SPARROW																+	+	+	+	+	+		+			R	Oct. - Mar.
LAPLAND LONGSPUR							+					+	+	+	+	+										O	Oct. - Mar.
SNOW BUNTING							+					+	+	+	+	+										O	Nov. - Mar.

' Species checklist and period of use from Bertrand and Scott, 1971; Gabrielson and Jewett, 1940; Giesler, 1952; Pimentel, 1950; Rehder, 1972; Scott, 1972; Silovsky, 1972; and Wampole, 1971a and 1971b.

* Species observed in this habitat

\+ Species not observed in this habitat but expected to use it

x Abundance: Key to abundance and abundance of birds not observed after Bertrant and Scott, 1971. Abundance underlined determined from this study, Silovsky, 1972.

APPENDIX TABLE 15. (CONTINUED)

VC - very common; 50 or more birds observed per day
C - common; 10-49 birds observed per day
U - uncommon, 0-9 birds observed per day
R - rare; 5 or less birds observed per year
O - occasional; not seen every year but occurs regularly
I - irregular; abundance and/or occurance fluctuates greatly from year to year
? - unknown; most of these species are probably irregular, occasional or rare

APPENDIX TABLE 16. DISTRIBUTION AMONG HABITATS, ABUNDANCE AND PERIOD OF USE OF MIGRATORY BIRDS USING THE OREGON DUNES NATIONAL RECREATION AREA.'

SPECIES	HABITATS (See page 47 for coding)										ABUNDANCE[x]	PERIOD OF USE
	J	B	O	E	R-S	L-P	SM	M	MMS	DG		
PINK-FOOTED SHEARWATER			+								U	? AND AUG., SEPT.
NEW ZEALAND SHEARWATER			+								R	? AND SEPT.
SOOTY SHEARWATER			*								VC	MAY, JUNE AND AUG.-OCT.
SLENDER-BILLED SHEARWATER			+								U	MAY AND SEPT., DEC., JAN
CANADA GOOSE					+		+	+	+	*	U	MAR.-MAY AND OCT., NOV.
WHITE-FRONTED GOOSE				+	+	+	+	+	+	+	R	APRIL AND SEPT., OCT.
SNOW GOOSE					+		+	+	+	+	R	MAR., APRIL AND OCT., NOV.
SEMIPALMATED PLOVER		*		*							U	APRIL, MAY AND AUG.
AMERICAN GOLDEN PLOVER		+		+							U	? AND AUG., SEPT.
RUDDY TURNSTONE	+										R	MAY AND AUG.
LONG-BILLED CURLEW							+			+	R	APRIL AND AUG.
WHIMBREL		*		*			+			*	U	APRIL, MAY AND AUG.
SOLITARY SANDPIPER					+		+			+	R	APRIL, MAY AND AUG.
WANDERING TATTLER	*										R	APRIL, MAY AND AUG.-OCT.
WILLET						+	+			+	R	APRIL, MAY AND SEPT., OCT.
LESSER YELLOWLEGS				+		+	+	+	+	+	R	APRIL, MAY AND SEPT.-NOV.
KNOT				+							R	? AND AUG.
PECTORAL SANDPIPER				+		+					R	APRIL, MAY AND SEPT., OCT.

APPENDIX TABLE 16. (CONTINUED)

SPECIES	HABITATS										ABUNDANCE[x]	PERIOD OF USE
	J	B	O	E	R-S	L-P	SM	M	MMS	DG		
BAIRDS SANDPIPER		+									R	? AND AUG., SEPT.
SHORT-BILLED DOWITCHER		+				*	+			+	C	APRIL AND?
LONG-BILLED DOWITCHER		+									VC	APRIL, MAY AND AUG., SEPT.
WESTERN SANDPIPER		*		*							VC	MAY AND AUG., SEPT.
MARBLED GODWIT		+		+							U	? AND AUG., SEPT.
RED PHALAROPE			+			+	+			+	C	APRIL, MAY AND AUG., SEPT.
WILLSON PHALAROPE						+	+			+	R	MAY AND ?
NORTHERN PHALAROPE		*		*			+			*	VC	MAY AND SEPT.
POMARINE JAEGER			+								U	APRIL, MAY AND AUG., SEPT.
PARASITIC JAEGER			+								U	APRIL AND AUG.
LONG TAILED JAEGER			+								U	?
BONAPARTES GULL			*	*		*					VC	APRIL, MAY AND AUG.-DEC.
SABINES GULL				+							U	MAY AND AUG., SEPT.
FORESTERS TERN				+		+	+	+	+		R	MAR., APRIL AND SEPT., OCT.
COMMON TERN			+	+							U	?
ARCTIC TERN			*	*		+					U	MAY AND AUG.
CASPIAN TERN		*	*	*		+					R	MAY AND SEPT., OCT
BLACK TERN						+					R	APRIL, MAY AND AUG., SEPT.

APPENDIX TABLE 16. (CONTINUED)

[1] Species checklist and period of use from Bertrand and Scott, 1971; Gabrielson and Jewett, 1940; Giesler, 1952; Pimentel, 1950; Reiher, 1972; Scott, 1972; Silovsky, 1972; and Wampole, 1971 a and b.

+ Species not observed in this habitat but expected to use it.

* Species observed in this habitat.

x Abundance: Key to abundance and abundance of birds not observed during this study after Bertrand and Scott, 1971. Abundance of birds determined from this study (Silovsky, 1972) underlined.

VC - Very common; 50 or more birds observed per day.
C - Common; 10-49 birds observed per day.
U - Uncommon; 0-9 birds observed per day.
R - Rare; 5 or less birds observed per year.

APPENDIX TABLE 17. WILDLIFE SPECIES WHICH MAY BE PRESENT ON THE OREGON DUNES NATIONAL RECREATION AREA.'

COMMON NAME	SCIENTIFIC NAME
Opossum	Didelphis Marsupialis
Townsend mole	Scapanus townsendi
Pallid bat	Antrozous pallidus
Mazama pocket gopher	Thomomys mazama
Dusky-footed woodrat	Neotoma fuscipes
Tailed-frog	Ascaphus truei
Foothill yellow-legged frog	Rana boylei
Pacific rubber boa	Charina bottae

' These species were found within a 15-mile radius of the Oregon Dunes National Recreation Area (Silovsky, 1972; Pimentel, 1950; and Maser, 1972)

APPENDIX TABLE 18. SCIENTIFIC NAMES OF PLANTS MENTIONED IN THE TEXT

COMMON NAME	SCIENTIFIC NAME
Alder, red	*Alnus rubra*
Austrian pine	*Pinus nigra*
Beach knotweed	*Polygonum paronychia*
Beach silver-top	*Glehnia leiocarpa*
Bentgrass	*Agrostis spp.*
Blackberry, trailing	*Rubus vititolius*
Bracken fern	*Pteridium aquilinum*
Brazilian waterweed	*Anarchis*
Brown-headed rush	*Juncus phaeocephalus*
Bulrush	*Scirpus validus*
California aster	*Aster chilensis*
Cattail	*Typha latifolia*
Cedar, western red	*Thuja plicata*
Centaury	*Centaurium umbellatum*
Coast strawberry	*Fragaria chiloensis*
Coontail	*Ceratophyllum*
Creeping buttercup	*Ranunculus flammula*
Douglas-fir	*Pseudotsuga menziesii*
European beachgrass	*Ammophila arenaria*
False dandelion	*Hypochoeris radicata*
Golden-eyed grass	*Sisyrinchium californicum*
Gray beach pea	*Lathyrus littoralis*
Hemlock, western	*Tsuga heterophylla*
Hind's sedge	*Carex hindsii*
Huckleberry, evergreen	*Vaccinium ovatum*
Huckleberry, red	*Vaccinium parvitolium*
Jack pine	*Pinus banksiana*
King's gentian	*Gentiana sceptrum*
Kinnikinnic	*Arctostaphylos uva-ursi*
Little hair grass	*Aira praecox*
Lodgepole pine	*Pinus contorta* var. *latifolia*
Manzanita	*Arcostaphylos columbiana*
Maple, vine	*Acer circinatum*
Maritime pine	*Pinus pinaster*
Monkey flower	*Mimulus guttatus*
Monterey pine	*Pinus radiata*
Pacific silver weed	*Potentilla pacifica*
Pacific willow-herb	*Epilobium franciscanum*
Pearly everlasting	*Anaphalis margaritacea*
Red fescue	*Festuca rubra*
Red flowering currant	*Ribes sanguineum*
Rhododendron	*Rhododendron macrophyllum*
Salal	*Gaultheria shallon*
Salmonberry	*Rubus spectabilis*
Salt rush	*Juncus lesmeurii*
Scot's pine	*Pinus sylvestris*
Scotch broom	*Cytisus scoparius*
Seashore bluegrass	*Poa macrantha*

APPENDIX TABLE 18. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Seashore lupine	*Lupinus littoralis*
Seaside tansy	*Tanacetum camphoratum*
Shorepine	*Pinus contorta*
Sickle-leaved rush	*Juncus falcatus*
Sitka spruce	*Picea sitchensis*
Skunk cabbage	*Lysichitum americanum*
Slough sedge	*Carex obnupta*
Spring-bank clover	*Trifolium wormskjoldii*
Sticky goldenrod	*Solidago spathulata*
Sword fern	*Polystichum munitum*
Thimbleberry	*Rubus parviflorus*
Water lily	*Nymphaeaceae*
Wax myrtle	*Myrica californica*
Willow, coast	*Salix hookeriana*
Yarrow	*Achillea millefolium*

APPENDIX TABLE 19. SCIENTIFIC NAMES OF FISHES MENTIONED IN THE TEXT AND APPENDIX

COMMON NAME	SCIENTIFIC NAME
Family Petromyzontidae	
Pacific lamprey	*Entosphenus tridentatus*
Western brook lamprey	*Lampetra planeri*
Family Squalidae	
Spiny dogfish	*Squalus acanthias*
Family Rajidae	
Longnose skate	*Raja rhina*
Family Acipenseridae	
Green sturgeon	*Acipenser medirostris*
White sturgeon	*Acipenser transmontanus*
Family Clupeidae	
American shad	*Alosa sapidissima*
Pacific herring	*Clupea harengus pallasi*
Family Engraulidae	
Northern anchovy	*Engraulis mordax*
Family Salmonidae	
Chum salmon	*Oncorhynchus keta*
Coho salmon	*O. kisutch*
Kokanee salmon	*O. nerka*
Chinook salmon	*O. tshawytscha*
Cutthroat trout (searun, resident)	*Salmo clarki*
Rainbow trout (steelhead)	*S. gairdneri*
Family Osmeridae	
White bait smelt	*Allosmerus elongatus*
Surf smelt	*Hypomesus pretiosus*
Eulachon	*Thaleichthys pacificus*
Longfin smelt	*Spirinchus thaleichthys*
Family Alepisauridae	
Longnose lancet fish	*Alepisaurus ferox*
Family Cyprinidae	
Columbia squawfish	*Ptychocheilus oregonense*
Redside shiner	*Richardsonius balteatus*
Blackside dace	*Rhinichthys osculus*
Carp	*Cyprinus carpio*

APPENDIX TABLE 19. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Family Catostomidae	
Largescale sucker	*Catostomus macrocheilus*
Family Gadidae	
Pacific tomcod	*Microgadus proximus*
Family Atherinidae	
Topsmelt	*Atherinops affinis*
Jacksmelt	*Atherinopsis californiensis*
Family Gasterosteidae	
Threespine stickleback	*Gasterosteus aculeatus*
Tubesnout	*Aulorhynchus flavidus*
Family Syngnathidae	
Bay pipefish	*Syngnathus griseolineatus*
Family Percichthyidae	*Morone saxatilis*
Striped bass	
Family Bramidae	
Pomfret	*Brama japonica*
Family Scianidae	
White Seabass	*Cynoscion noblis*
Family Embiotocidae	
Shiner perch	*Cymatogaster aggregata*
Striped seaperch	*Embiotoca lateralis*
Silver surf perch	*Hyperprosopon ellipticum*
Walleye surf perch	*H. argenteum*
White seaperch	*Phanerodon furcatus*
Pile perch	*Rhacochilus vacca*
Redtail surf perch	*Amphistichus rhodoterus*
Family Stichaeidae	
High cockscomb	*Anoplarchus purpurescens*
Snake prickleback	*Lumpenus sagitta*
Family Pholidae	
Penpoint gunnel	*Apodichthys flavidus*
Saddleback gunnel	*Pholis ornata*
Family Anarrhichadidae	
Wolf-eel	*Anarrhichthys ocellatus*
Family Ammodytidae	
Pacific sand lance	*Ammodytes hexapterus*

COMMON NAME	SCIENTIFIC NAME
Family Gobiidae	
Arrow goby	Clevelandia ios
Bay goby	Lepidogobious lepidus
Family Stromateidae	
Pacific pompano	Peprilus simillimus
Family Scorpaenidae	
Copper rockfish	Sebastes caurinus
Black rockfish	S. melanops
Bocaccio	S. paucispinis
Family Hexagrammidae	Hexagrammos decagrammus
Kelp greenling	Hexagrammos decagrammus
Rock greenling	H. lagocephalus
Lingcod	Ophiodon elongatus
Family Cottidae	
Padded sculpin	Artedius fenestralis
Mosshead sculpin	Clinocottus globiceps
Prickly sculpin	Cottus asper
Buffalo sculpin	Enophrys bison
Pacific staghorn sculpin	Leptocottus armatus
Tidepool sculpin	Oligocottus maculosus
Fluffy sculpin	O. snyderi
Cabezon	Scorpaenichthys marmoratus
Family Agonidae	
Tubenose poacher	Pallasina barbata
Family Bothidae	
Speckled sanddab	Citharichtyhys stigmaeus
Family Pleuronectidae	
English sole	Parophrys vetulus
Starry flounder	Platickthys stellatus
Sand sole	Psettichthys melanostictus
Family Ictauridae	
Brown bullhead	Ictalurus nebulosus
Family Centrarchidae	
Largemouth bass	Micropterus salmoides
Bluegill	Lepomis macrochirus
Warmouth bass	Chaenobryttus gulosus
White crappie	Pomoxis annularis
Black crappie	P. nigromaculatus
Family Percidae	
Yellow perch	Perca Havescens

APPENDIX TABLE 20. SCIENTIFIC NAMES OF AMPHIBIANS AND REPTILES MENTIONED IN THE TEXT AND APPENDIX

COMMON NAME	SCIENTIFIC NAME
Order Caudata (Salamanders)	
Family Ambystomidae	
Northwestern Salamander	Ambystoma gracile
Pacific Giant Salamander	Dicamptodon ensatum
Olympic Salamander	Rhyacotriton olympicus
Family Salamandridae	
Rough-skinned newt	Taricha granulosa
Dunn's salamander	Plethodon dunni
Western red-backed salamander	Plethodon vehiculum
Oregon slender salamander	Batrachoseps wrighti
Clouded salamander	Aneides ferreus
Order Salientia	
Family Bufonidae	
Western toad	Bufo boreas
Family Hylidae	
Pacific tree frog	Hyla regilla
Family Ranidae	
Red-legged frog	Rana aurora
Bullfrog	Rana catesbeiana
Order Squamata (Lizards and Snakes)	
Family Anguidae	
Northern Alligator Lizard	Gerrhonotus coeruleus
Family Colubridge	
Northwestern Garter Snake	Thamnophis ordinoides
Common Garter Snake	Thamnophis sirtalis

APPENDIX TABLE 21. SCIENTIFIC NAMES OF BIRDS MENTIONED IN THE TEXT AND APPENDIX

COMMON NAME	SCIENTIFIC NAME
Order Gaviiformes	
Family Faviidae	
Common Loon	Gavia immer
Arctic Loon	Gavia arctica
Red-throated Loon	Gavia stellata
Order Podicipediformes	
Family Podicipedidae	
Red-necked Grebe	Podiceps grisegena
Horned Grebe	Podiceps auritus
Eared Grebe	Podiceps caspicus
Western Grebe	Aechmophorus occidentalis
Pied-billed Grebe	Podilymbus podiceps
Order Procellariformes	
Family Diomededea	
Black-footed Albatross	Diomedea nigripes
Family Procellariidae	
Fulmar	Fulmarus glacialis
Pink-footed Shearwater	Puffinus creatopus
New Zealand Shearwater	Puffinus bulleri
Sooty Shearwater	Puffinus griseus
Slender-billed Shearwater	Puffinus tenuirostris
Family Hydrobatidae	
Fork-tailed Petrel	Oceanodroma furcata
Leach's Petrel	Oceanodroma leucorhoa
Order Pelecaniformes	
Family pelecanidae	
Brown Pelican	Pelecanus occidentalis
Family Phalcrocoracidae	
Double-crested Cormorant	Phalacrocorax auritus
Brandt's Cormorant	Phalacrocorax penicillatus
Pelagic Cormorant	Phalacrocorax pelagicus
Order Ciconiformes	
Family Ardeidae	
Great Blue Heron	Ardea herodias
Green Heron	Butorides virescens
Common Egret	Casmerodius albus
Black-crowned Night Heron	Nycticorax nycticorax
American Bittern	Botaurus lentiginosus

APPENDIX TABLE 21. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Order Anseriformes	
Family Anatidae	
Whistling Swan	Olor columbianus
Canada Goose	Branta canadensis
Snow Goose	Chen hyperborea
Black Brant	Branta nigricans
White-fronted Goose	Anser albifrons
Mallard	Anas platyrhynchos
Gadwall	Anas strepera
Pintail	Anas acuta
Green-winged Teal	Anas carolinensis
Blue-winged Teal	Anas discors
Cinnamon Teal	Anas cyanoptera
American Widgeon	Mareca americana
Shoveler	Spatula clypeata
Wood Duck	Aix sponsa
Redhead	Aythya americana
Ring-necked Duck	Aythya collaris
Canvasback	Aythya valisineria
Greater Scaup	Aythya marila
Lesser Scaup	Aythya affinis
Common Goldeneye	Bucephala clangula
Barrows Goldeneye	Bucephala islandica
Bufflehead	Bucephala albeola
Old Squaw	Clangula hyemalis
Harlequin Duck	Histrionicus histrionicus
White-winged Scoter	Melanitta deglandi
Surf Scoter	Melanitta perspicillata
Common Scoter	Oidemia nigra
Ruddy Duck	Oxyura jamaicensis
Hooded Merganser	Lophodytes cucullatus
Common Merganser	Mergus merganser
Red-breasted Merganser	Mergus serrator
Order Falconiformes	
Family Cathartidae	
Turkey Vulture	Cathartes aura
Family Accupitridae	
Sharp-shinned Hawk	Accipiter striatus
Cooper's Hawk	Accipiter cooperii
Red-tailed Hawk	Buteo jamaicensis
Rough-legged Hawk	Buteo lagopus
Bald Eagle	Haliaeetus leucocephalus
Marsh Hawk	Circus cyaneus

APPENDIX TABLE 21. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Family Pandionidae	
Osprey	Pandion haliaetus
Family Falconidae	
Peregrine Falcon	Falco peregrinus
Pigeon Hawk	Falco columbarius
Sparrow Hawk	Falco sparverius
Order Galliformes	
Family Tetraonidae	
Blue Grouse	Dendragapus obscurus
Ruffed Grouse	Bonasa umbellus
Family Phasianidae	
Mountain Quail	Oreortyx pictus
California Quail	Lophortyx californicus
Ring-necked Pheasant	Phasianus colchicus
Family Rallidae	
Virginia Rail	Rallus limicola
Sora	Porzana carolina
American Coot	Fulica americana
Order Charadriiformes	
Family Haematopodidae	
Black Oystercatcher	Haematopus bachmani
Family Charadriidae	
Semipalmated Plover	Charadrius semipalmatus
Snowy Plover	Charadrius alexandrinus
Killdeer	Charadrius vociferus
American Golden Plover	Pluvialis dominica
Black-bellied Plover	Squatarola squatorola
Surfbird	Aphriza virgata
Ruddy Turnstone	Arenaria interpres
Black Turnstone	Arenaria melanocephala
Family Scolopacidae	
Common Snipe	Capella gallinago
Long-billed Curlew	Numenius americanus
Whimbrel	Numenius phaeopus

APPENDIX TABLE 21. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Spotted Sandpiper	*Actitis macularia*
Solitary Sandpiper	*Tringa solitaria*
Wandering Tattler	*Heteroscelus incanum*
Willet	*Catoptrophorus semipalmatus*
Greater Yellowlegs	*Totanus melanoleucus*
Lesser Yellowlegs	*Totanus flavipes*
Knot	*Calidris canutus*
Pectoral Sandpiper	*Erolia melanotos*
Baird's Sandpiper	*Erolia bairdii*
Least Sandpiper	*Erolia minutilla*
Dunlin	*Erolia alpina*
Short-billed Dowitcher	*Limnodromus griseus*
Long-billed Dowitcher	*Limnodromus scolopaceus*
Western Sandpiper	*Ereunetes mauri*
Marbled Godwit	*Limosa fedoa*
Sanderling	*Crocethia alba*
Family Phalaropodidae	
Red Phalarope	*Phalaropus fulicarius*
Wilson's Phalarope	*Steganopus tricolor*
Northern Phalarope	*Lobipes lobatus*
Family Stercorariidae	
Pomarine Jaeger	*Stercorarius pomarinus*
Parasitic Jaeger	*Stercorarius parasiticus*
Long-tailed Jaeger	*Stercorarius longicaudus*
Family Laridae	
Glaucous Gull	*Larus hyperboreus*
Glaucous-winged Gull	*Larus glaucescens*
Western Gull	*Larus occidentalis*
Herring Gull	*Larus argentatus*
California Gull	*Larus californicus*
Ring-billed Gull	*Larus delawarensis*
Mew Gull	*Larus canus*
Bonaparte's Gull	*Larus philadelphia*
Heermann's Gull	*Larus heermanni*
Black-legged Kittiwake	*Rissa tridactyla*
Sabine's Gull	*Xema sabini*
Common Tern	*Sterna hirundo*
Arctic Tern	*Sterna paradisaea*
Caspian Tern	*Hydroprogne caspia*
Black Tern	*Chlidonias niger*

APPENDIX TABLE 21. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Family Alcidae	
Common Muure	*Uria aalge*
Pigeon Guillemot	*Cepphus columba*
Marbled Murrelet	*Brachyramphus marmoratum*
Ancient Murrelet	*Synthliboramphus antiquum*
Cassin's Auklet	*Ptychoramphus aleutica*
Parakeet Auklet	*Cyclorrhynchus psittacula*
Rhinoceros Auklet	*Cerorhinca monocerata*
Horned Puffin	*Fratercula corniculata*
Tufted Puffin	*Lunda cirrhata*
Order Columbiformes	
Family Columbidae	
Band-tailed Pigeon	*Columba fasciata*
Mourning Dove	*Zenaidura macroura*
Order Strigiformes	
Family Tytonidae	
Barn Owl	*Tyto alba*
Family Strigidae	
Screech Owl	*Otus asio*
Great Horned Owl	*Bubo virginianus*
Snowy Owl	*Nyctea scandiaca*
Pygmy Owl	*Glaucidium gnoma*
Long-eared Owl	*Asio otus*
Short-eared Owl	*Asio flammeus*
Saw-whet Owl	*Aegolius acadicus*
Order Caprimulgiformes	
Family Caprimulgidae	
Common Nighthawk	*Chordeles minor*
Order Apodiformes	
Family Apodidae	
Vaux's Swift	*Chaetura vauxi*
Family Trochilidae	
Anna's Hummingbird	*Calypte anna*
Rufous Hummingbird	*Selasphorus rufus*
Allen's Hummingbird	*Selasphorus sasin*
Order Coraciiformes	
Family Alcedinidae	
Belted Kingfisher	*Megaceryle alcyon*

APPENDIX TABLE 21. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Order Piciformes	
Family Picidae	
Yellow-shafted Flicker	*Colaptes auratus*
Red-shafted Flicker	*Colaptes cafer*
Pileated Woodpecker	*Dryocopus pileatus*
Lewis' Woodpecker	*Asyndesmus lewis*
Yellow-bellied Sapsucker	*Sphyrapicus varius*
Hairy Woodpecker	*Dendrocopos villosus*
Downy Woodpecker	*Dendrocopos pubescens*
Order Passeriformes	
Family Tyrannidae	
Western Kingbird	*Tyrannus verticalis*
Traill's Flycatcher	*Empidonax trailli*
Western Flycatcher	*Empidonax difficilis*
Hammond's Flycatcher	*Empidonax hammondii*
Dusky Flycatcher	*Empidonax oberholseri*
Western Wood Pewee	*Contopus sordidulus*
Olive-sided Flycatcher	*Nuttallornis borealis*
Family Alaudidae	
Horned Lark	*Eremophila alpestris*
Family Hirundinidae	
Violet-green Swallow	*Tachycineta thalassina*
Tree Swallow	*Iridoprocne bicolor*
Bank Swallow	*Riparia riparia*
Rough-winged Swallow	*Stelgidopteryx ruficollis*
Barn Swallow	*Hirundo rustica*
Cliff Swallow	*Petrochelidon pyrrhonota*
Purple Martin	*Progne subis*
Family Corvidae	
Gray Jay	*Perisoreus canadensis*
Steller's Jay	*Cyanocitta stelleri*
Common Raven	*Corvus corax*
Common Crow	*Corvus brachyrhynchos*
Family Paridae	
Black-capped Chickadee	*Parus atricapillus*
Chestnut-backed Chickadee	*Parus rufescens*
Mountain Chickadee	*Parus gambeli*
Common Bushtit	*Psaltriparus minimus*

APPENDIX TABLE 21. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Family Sittidae	
White-breasted Nuthatch	Sitta carolinensis
Red-breasted Nuthatch	Sitta canadensis
Family Certhiidae	
Brown Creeper	Certhia familiaris
Family Chamaeidae	
Wrentit	Chamaea fasciata
Family Troglodytidae	
House Wren	Troglodytes aedon
Winter Wren	Troglodytes troglodytes
Bewick's Wren	Thryomanes bewickii
Long-billed Marsh Wren	Telmatodytes palustris
Family Turdidae	
Robin	Turdus migratorius
Varied Thrush	Ixoreus nasvius
Hermit Thrush	Hylocichla guttata
Swainson's Thrush	Hylocichla ustulata
Western Bluebird	Sialia mexicana
Townsend's Solitaire	Myadestes townsendi
Family Sylviidae	
Golden-crowned Kinglet	Regulus satrapa
Ruby-crowned Kinglet	Regulus calendula
Family Motacillidae	
Water Pipit	Anthus spinoletta
Family Bombycillidae	
Bohemian Waxwing	Bombycilla garrula
Cedar Waxwing	Bombycilla cedrorum
Family Laniidae	
Northern Shrike	Lanius excubitor
Family Sturnidae	
Starling	Sturnus vulgaris
Family Vireonidae	
Hutton's Vireo	Vireo huttoni
Solitary Vireo	Vireo solitarius
Warbling Vireo	Vireo gilvus

APPENDIX TABLE 21. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Family Parulidae	
Orange-crowned Warbler	Vermivora celata
Nashville Warbler	Vermivora ruficapilla
Yellow Warbler	Dendroica petechia
Myrtle Warbler	Dendroica coronata
Audubon's Warbler	Dendroica auduboni
Black-throated Gray Warbler	Dendroica nigrescens
Townsend's Warbler	Dendroica townsendi
Hermit Warbler	Dendroica occidentalis
MacGillivray's Warbler	Oporornis tolmiei
Yellowthroat	Geothlypis trichas
Yellow-breasted Chat	Icteria virens
Wilson's Warbler	Wilsonia pusilla
Family Ploceidae	
House Sparrow	Passer domesticus
Family Icteridae	
Western Meadowlark	Sturnella neglecta
Red-winged Blackbird	Agelaius phoeniceus
Brewer's Blackbird	Euphagus cyanocephalus
Brown-headed Cowbird	Molothus ater
Family Thraupidae	
Western Tanager	Piranga ludoviciana
Family Fringillidae	
Black-headed Grosbeak	Pheucticus melanocephalus
Lazuli Bunting	Passerina amoena
Evening Grosbeak	Hesperiphona vespertina
Purple Finch	Carpodacus purpureus
House Finch	Carpodacus mexicanus
Pine Siskin	Spinus pinus
American Goldfinch	Spinus tristis
Lesser Goldfinch	Spinus psaltria
Red Crossbill	Loxia curvirostra
Rufous-sided Towhee	Pipilo erythrophthalmus
Savannah Sparrow	Passerculus sandwichensis
Vesper Sparrow	Pooecetes gramineus
Slate-colored Junco	Junco hyemalis
Oregon Junco	Junco oreganus
Chipping Sparrow	Spizella passerina
White-crowned Sparrow	Zonotrichia leucophrys
Golden-crowned Sparrow	Zonotrichia atricapilla

APPENDIX TABLE 21. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
White-throated Sparrow	*Zonotrichia albicollis*
Fox Sparrow	*Passerella iliaca*
Lincoln's Sparrow	*Melospiza lincolnii*
Song Sparrow	*Melospiza melodia*

APPENDIX TABLE 22. SCIENTIFIC NAMES OF MAMMALS MENTIONED IN THE TEXT AND APPENDIX.

COMMON NAME	SCIENTIFIC NAME
Order Insectivora	
Family Soricidae	
Pacific Shrew	Sorex Pacificus
Vagrant Shrew	S. vagrans
Marsh Shrew	S. bendirii
Trowbridge Shrew	S. trowbridgii
Family Talpidae	
Pacific Mole	Scapanus orarius
Shrew-mole	Neurotrichus gibbsii
Order Chiroptera	
Family Vespertilionidae	
Little Brown Myotis	Myotis lucifugus
Fringed Myotis	M. thysanodes
California Myotis	M. californicus
Long-legged Myotis	M. volans
Long-eared Myotis	M. evotis
Hoary Bat	Lasiurus cinereus
Silvery-haired Bat	Lasionycteris noctivagans
Big Brown Bat	Eptesicus fuscus
Western Big-eared Bat	Plecotus townsendi
Order Lagomorpha	
Family Leporidae	
Snowshoe Hare	Lepus americanus
Brush Rabbit	Sylvilagus bachmani
Order Rodentia	
Family Aplodontidae	
Mountain Beaver	Aplodontia rufa
Family Sciuridae	
California Ground Squirrel	Spermophilus beecheyi
Townsend Chipmunk	Eutamias townsendi
Chickaree	Tamiasciurus douglasi
Northern Flying Squirrel	Glaucomys sabrinus
Family Castoridae	
Beaver	Castor canadensis

APPENDIX TABLE 22. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Family Cricetidae	
Deer Mouse	Peromyscus maniculatus
Bushy-tailed woodrat	Neotoma cinerea
White-footed vole	Phenacomys albipes
Red-tree Mouse	Arborimus longicaudus
California Red-backed vole	Clethrionomys occidentalis
Townsend vole	Microtus townsendi
Longtail vole	M. longicaudus
Oregon vole	M. oregoni
Muskrat	Ondatra zibethica
Family Zapodidae	
Pacific Jumping Mouse	Zapus trinotatus
Family Erethizontidae	
Porcupine	Erethizon dorsatum
Order Carnivora	
Family Canidae	
Gray Fox	Urocyon cinereoargenteus
Coyote	Canis latrans
Family Ursidae	
Black Bear	Ursus americanus
Family Procyonidae	
Raccoon	Procyon lotor
Family Mustelidae	
Marten	Martes americana
Mink	Mustela vison
Long-tailed Weasel	M. frenata
Short-tailed Weasel	M. erminea
Striped Skunk	Mephitis mephitis
Spotted Skunk	Spilogale putorius
River Otter	Lutra canadensis
Family Felidae	
Mountain Lion	Felis concolor
Bobcat	Lynx rufus
Order Pinnipedia	
Family Otariidae	
Steller Sea Lion	Eumetopias jubata
California Sea Lion	Zalophus californianus

APPENDIX TABLE 22. (CONTINUED)

COMMON NAME	SCIENTIFIC NAME
Family Phocidae	
Harbor Seal	*Phoca vitulina*
Elephant Seal	*Mirounga angustirostris*
Order-Artiodactyla	
Family Cervidae	
Roosevelt Elk	*Cervus canadensis*
Black-tailed Deer	*Odocoileus hemionus*

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